University of Alberta

Assessment of Dietary Intake In Accordance with Recommendations to Reduce the Risk of Cancer Among Adult Alberta Residents: The Alberta Nutrition Survey

by

Kimberley Ransome ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Science

in

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ABSTRACT

An Alberta wide nutrition survey of 2,049 adults between 18 and 74 years was conducted between 1994 and 1995 to estimate nutrient intake. This survey estimated the intake of nutrients using a 24 h recall and alcohol using a food frequency questionnaire. Estimated intakes were described according to various sociodemographic and socioeconomic characteristics (including age and sex, marital status, reported income level, education, employment status and smoking). Data regarding concern about cancer was collected by an interviewer administered questionnaire and anthropometric measures (height and weight) were done by interviewers following standardized protocols. This data was used in the present study to examine the intake of Alberta residents as it relates to the American Cancer Society's recommendations (including percent energy from total fat, saturated fat, dietary fibre, antioxidant intake and weekly alcohol consumption). Descriptive statistics, one-way analysis of variance (ANOVA) and X^2 analyses were used to assess the effect of independent variables with estimated food, nutrient and alcohol intake. Overall, data from the Alberta Nutrition Survey (ANS) suggests that approximately half of the Alberta population did not meet the recommendation to consume 30% or less energy from total fat. The majority of residents consumed below recommended levels of dietary fibre (20-30 grams per day), and many residents consumed low intakes of vegetables and fruit as measured by the intake of select antioxidants (carotenoids and vitamin C). While the proportion of Alberta residents classified as underweight appears to have decreased, the proportion of Alberta residents who have a BMI that place them at risk for certain types of cancer (as well as heart disease and diabetes) appears to have remained the same. Respondents who reported a concern about

cancer consumed significantly ($p < 0.05$) less total alcohol, beer and alcohol from spirits per week, but similar amounts of wine, than respondents who did not report a concern about cancer. Overall, results from the Alberta Nutrition Survey suggest that on average Alberta residents are not meeting current dietary recommendations.

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ABBREVIATIONS

AADAC: Alberta Alcohol and Drug Abuse Commission
ANOVA: Analysis of Variance
ANS: Alberta Nutrition Survey
BMI: Body Mass Index
BNS: Bureau of Nutritional Sciences
CANDI: Canadian Dietary Reference Information System
CNF: Canadian Nutrient File
DHA: Docosahexaenoic Acid
DIN: Drug Identification Number
DNA: Deoxyribonucleic Acid
EPA: Eicosapentaenoic Acid
HDL: High Density Lipoprotein
IBW: Ideal Body Weight
LDL: Low Density Lipoprotein
MEOS: Microsomal Ethanol Oxidizing System
NAD: Nicotinamide Adenine Dinucleotide
NHANES: National Health and Nutrition Examination Survey
NPHS: National Population Health Survey
P/S: Polyunsaturated:Saturated Fat Ratio
RCMP: Royal Canadian Mounted Police
RNI: Recommended Nutrient Intake
USDA: United States Department of Agriculture
WHR: Waist Hip Ratio
X^2: Chi-square analysis

CHAPTER ONE

A. INTRODUCTION

Despite several advances in science and technology there remains no cure for cancer and several forms of the disease are without clinical recourse. In Alberta, it is estimated that there will be 10,100 new cases of cancer (excluding non-melanoma skin cancer), and approximately 4,900 Alberta residents will die from cancer in 2000 (Canadian Cancer Statistics, 2000). Cancer is a chronic pathological process characterized by unregulated, disorganized proliferation of cell growth (Taber's Cyclopedic Medical Dictionary, 1989) following a change, or series of changes, in the genome of a single cell (Cancer Prevention Annual Report, 1990).

Cancer agencies have interpreted the research as suggesting that between thirty and forty percent of cancers could be prevented by following a healthy diet and maintaining an active lifestyle (Food, Nutrition and the Prevention of Cancer, 1997). However, less than fifty percent of Alberta residents believe that cancer prevention is related to lifestyle choices, including dietary choices (Alberta Cancer Board, 1990). In 1997, the World Cancer Research Fund in association with the American Institute for Cancer Research published a report titled *Food, Nutrition and the Prevention of Cancer: a global perspective*. This international report listed fourteen public health recommendations that are aimed at reducing the age specific incidence rate of cancer. Prior to 1997, the American Cancer Society (1996) published six recommendations, most of which are related to food:

1. Maintaining a healthy body weight;
2. Reducing total fat intake to 30% or less of total calories;
3. Including between 20 to 30 grams of dietary fibre daily;
4. Consuming foods rich in antioxidants including vitamins A and C as well as carotenes in the daily diet;
5. Limiting consumption of alcohol if consumed at all; and
6. Limiting the use of salt and nitrate preserved foods

These recommendations result from the interpretation of experts of the numerous epidemiological and laboratory based studies examining the relationship between diet and cancer.

B. NUTRITION SURVEYS

The last nutritional data base available to Alberta residents is the Nutrition Canada Survey (1973). The results from this National Survey were intended to be used to identify specific problems and priorities among the Canadian population, and to assist in the development of effective food legislation and public health and welfare programs (Sabry, 1974 and Campbell, 1970). In 1994, the Alberta Nutrition Survey (ANS) was conducted by Alberta Health in conjunction with Health Canada and the Bureau of Nutritional Sciences. This large, cross sectional nutritional survey was conducted to establish a database to describe the nutritional intake of Alberta residents.

The goals of the ANS (1994) were to:

1) assess the food consumption patterns of Alberta residents and to estimate the distribution of dietary intakes of macronutrients and micronutrients;
2) identify groups which would constitute a priority for intervention and;
3) assess the knowledge and attitudes regarding diet, chronic disease and beliefs about food.

C. RATIONALE

Currently, it is unknown whether Alberta residents are following the American Cancer Society's (1996) food based recommendations to reduce the age specific incidence rate of cancer. Therefore, the current research was conducted using data from the ANS (1994) to describe whether Alberta residents are meeting the American Cancer Society's (1996) six recommendations. As many of these recommendations are similar to recommendations proposed by the Heart and Stroke Foundation of Canada and the Canadian Diabetes Association, results from this investigation may be useful to identify groups which are less likely to meet these specific public health goals.

CHAPTER TWO

A. PURPOSE

The current research was conducted to determine whether the estimated dietary intake (obtained from the Alberta Nutrition Survey) in the Alberta population is consistent with the American Cancer Society's (1996) recommendations to reduce the age specific incidence rate of cancer.

Specific objectives

A. To describe the range of body mass indices among the Alberta population and determine the proportion of Alberta residents who are described as underweight or overweight according to the National Population Health Survey criteria.

B. To estimate the dietary fat intake as a percentage of total energy among the Alberta population, and determine the proportion of Alberta residents who may be exceeding the recommendation by consuming a diet high in fat (defined as greater than 30% of total energy).

   1. To describe the composition of dietary fat intake among the Alberta population.
   2. To determine if fat intake is different between smokers and non-smokers.

C. To describe the dietary fibre intake among the Alberta population, and determine the proportion of Alberta residents who may be consuming a diet low in dietary fibre (defined as less than 20 grams per day).

   1. To determine if fibre intake is different between smokers and non-smokers.
   2. To examine the dietary fibre intake in relation to the estimated total fat intake (as a percentage of total energy) in the Alberta population.

D. To describe the dietary intake of foods rich in antioxidants, particularly vitamin A, vitamin C, and carotenes, among the Alberta population.

   1. To determine if smokers consume less dietary antioxidants than non-smokers.

E. To estimate the consumption level of alcoholic beverages among the Alberta population, and determine the proportion of Alberta residents who may be exceeding the recommendation (defined as no more than 2 drinks per day for men and no more than 1 drink per day for women).

   1. To determine if smokers consume more alcohol than non-smokers.
   2. To assess the relationship between alcohol intake and the intake of nutrients adversely affected by alcohol consumption, including dietary folate, thiamin, riboflavin and vitamin C.

F. To estimate the consumption of salt among the Alberta population, and determine the proportion of Alberta residents who may be exceeding the recommendation.

CHAPTER THREE

I. METHODOLGY

A. DATA COLLECTION

The Alberta Nutrition Survey (ANS) is a collaborative health initiative between Alberta Health and Health Canada. The dietary intake component of the survey methodology was developed in Nova Scotia and provided the protocol for the ANS. The survey was used to conduct a comprehensive analysis of the sociodemographic and socioeconomic factors that contribute to the dietary habits and perceived nutrition concerns of Alberta residents between 18-74 years of age. Excluded from the survey protocol were children, adolescents, pregnant women, aboriginal people with Treaty status, RCMP and military personnel.

B. STATISTICAL DESIGN

The Alberta Nutrition Survey included a stratified probability sample of three thousand six hundred sixty (3,660) non-institutionalized Alberta residents, which were originally obtained from thirteen of 27 Alberta Health Units. The sample was drawn from the 13 randomly selected health units that participated in the Alberta Heart Health Survey. The Alberta Health Care Insurance Plan (AHCIP) was used to divide Alberta residents into 3 strata or subgroups based on geographic location, age and sex. Stratum 1, which consisted of the 7 larger urban centers, included Edmonton, Calgary, Medicine Hat, Lethbridge, Red Deer, Grand Prairie and Fort McMurray. Stratum 2 included Big Country, Leduc-Strathcona, North Eastern Alberta and Sturgeon and stratum 3 included Athabasca and Peace River. Stratification by geographic location was based on population size. Individuals were then selected from within each stratum (or area) based on 12 age-sex groups according to the groupings used by the AHCIP. An expert panel recommended using 8 age-sex groups during the Data Interpretation Committee meeting in Nova Scotia however, these groups were used for analytical design and could not be used for sampling design. Within each strata or subgroup samples were randomly drawn using postal codes that represented mailing addresses rather than physical addresses. This approach was taken to reduce the variance and increase the likelihood that the sample drawn would be representative of the socioeconomic characteristics of the Alberta population aged 18-74 years. Due to the sampling design it is possible that an individual's estimated food intake could be recorded under stratum 1, based on mailing address, even though that individual resides in stratum 2 or 3. Therefore, a potential limitation of the sampling design used in the ANS was that a portion of the sample drawn may not be truly reflective of the socioeconomic characteristics of the region sampled. Moreover, the sampling procedure used would only represent 75% of the Alberta population. The data for the Alberta Nutrition Survey was collected in the Spring (April 25 to July 22) and Fall (October 10 to December 21) of 1994 to capture seasonal variations in food intake. Interview days were assigned randomly and were distributed over the seven days of the week.

The statistical design allowed for comparisons among sociodemographic and socioeconomic groups (according to age and sex and self-reported household income level, educational attainment and employment status) as well as smoking. Therefore, there is the potential for "respondent bias" whereby individuals underestimate or overestimate their age and or household income level.

One thousand four hundred sixty four (1,464) potential respondents were contacted by telephone during the first season and two thousand one hundred ninety six (2,196) respondents were contacted during the second season. Two thousand fifty three (2,053) respondents were interviewed during the two seasons for a total response rate of fifty six percent (56%). Five hundred fifty three (553) respondents of the two thousand fifty three (2,053) were pre-selected to be re-interviewed to assess for the intra-individual (or day to day) variation in intakes that occur using the 24 hour dietary recall. The refusal (non-respondent) rate over the two seasons averaged twenty one percent (21%). Approximately twenty trained interviewers (16 dietitians/nutritionists and 4 nurses) conducted the interviews in the respondents' home using calibrated food models to assist in the estimation of portion sizes. Another potential source of bias therefore includes the respondent's incorrect estimation of portion size. During the home visit, each respondent was interviewed according to:

I. a modified food frequency questionnaire;
II. a nutrition, activity and health questionnaire;
III. a demographic profile questionnaire;

a) anthropometric measurements included height, weight, and girth measurements to calculate body mass index (BMI) and waist:hip ratio (WHR); and

I. a 24 hour dietary recall;

C. INTERVIEWER TRAINING

The twenty interviewers were trained during a ten day intensive training session prior to the first phase of data collection. Although the 20 interviewers received the same training, an unknown measure of "information" bias may have been introduced during the interview process. Some interviewers may have been more effective than others at securing an interview, prompting for detailed quantitative or qualitative information (such as serving size or alcohol consumption), and or obtaining anthropometric measurements. Although it was standard procedure for three waist hip measurements to be taken if the variance between the first two measurements was greater than 0.4 cm, some interviewers only took two measurements. In this case, the average of the two measurements was recorded.

In addition, responses may have varied as nurses and dietitians (and or nutritionists) may have been perceived differently by an individual and or (urban or rural) community due to public perception regarding the role of health care provider at that time. The training sessions were conducted by a nutrition expert experienced in the execution of nutrition surveys (Elizabeth Campbell Asselbergs) to minimize the effect of interviewer bias.

The primary objectives of the training sessions were to ensure accurate recording of food data, consistency in interviewing techniques, and adherence to survey protocol. The Interviewers' Resource and Training Manual (adapted from the Nova Scotia and Saskatchewan Nutrition Survey manuals) were used as the basis for training and as a reference when administering questionnaires during data collection. Each interviewer was evaluated in the techniques and appropriate recording of dietary information at the end of the training session. A two day re-training session for all survey personnel was held prior to the beginning of the second season of data collection. At this time, the survey protocol and standard procedures were reviewed and reinforced. The retraining workshop was conducted one week prior to commencement of the second phase of data collection in the fall of 1994.

The quality control supervisor was responsible for the data flow and quality control during the survey. Five facilitators were responsible for review of the survey packages and for communication with interviewers regarding problems and changes. Interviewers in Calgary and Edmonton reported directly to a facilitator in their area while interviewers in other areas reported to facilitators based at Alberta Health. Close contact was to be maintained between the quality control supervisor, the facilitators and interviewers.

A series of standardized, timely checks were built into every stage of data collection and review. Observations were made by the training facilitator, the quality control supervisor, the survey coordinator and the facilitators in the practice sessions. All forms from the practice sessions were reviewed by the facilitators and the training facilitator. Written and verbal feedback were given to the interviewers after each practice session. During data collection a record of calls and a thorough review of the forms used by the interviewer was documented. A second review of the process was conducted by the facilitator and supervisor, and a final review of the process was conducted by the Health Protection Branch in Ottawa. The principal investigator was responsible for monitoring response rates by computer after select data were entered into the computer by a research assistant.

D. CONTACT OF RESPONDENTS

Before any contact was made with the potential interviewee, the identifier number (5 digits) for that individual was entered onto a "Record of Calls and Appointments" form. Each respondent had a separate "Record of Calls and Appointments" form. All attempts made to contact the potential respondent by telephone or in person to arrange an appointment were to be recorded on this form along with the date and the time called to ensure that all follow up attempts were made at different times of the day and week.

Respondents were contacted by phone to make appointments for home interviews on the day of the week assigned on the printout. A minimum of five attempts were made to contact a respondent. These contact attempts were made at different times of the day (e.g. morning, afternoon and evening). After every attempt, the reason for the "non-contact" was noted on the "Record of Calls and Appointments Form" for that individual (no answer, phone line busy, not at home, the telephone is not in service or the selected respondent was unavailable).

If the first call and a check of the local address did not locate the subject (e.g. not known at this address/number), attempts were made to try to find out where the individual resided. If in the vicinity of a potential respondent, where telephone contact had been unsuccessful, attempts to make contact to schedule an appointment were made by the interviewer. A direct visit to a potential respondent's home may have secured an interview, particularly if there was no telephone in the household. If no one was home, then a business card or letter was left. For hard-to-reach individuals unable to be contacted by telephone or home visit, a letter was mailed in an attempt to secure an interview. This was only used as a last measure.

The survey progress tally sheet was used to track the cumulative progress of the survey by geographic location. The tally sheet was to be completed by each interviewer on a weekly basis. The form allowed the survey investigators to track the total cumulative number of respondents located and the contact outcome finalized. If the participant completed most of the interview but was called away, got bored or refused to continue, the interview was considered a complete response if the 24 hour recall **and** the food frequency questionnaire was completed. An interview that was started but interrupted by an emergency was re-scheduled on the same assigned interview day the following week. If the 24 hour recall was started but not completed, it was repeated again from the beginning at another appointment. If only the 24 hour recall was completed, then the remaining questionnaires were to be filled in at another convenient time as determined by the respondent and the interviewer. If either the 24 hour recall or the food frequency questionnaire was not fully completed, then the interview was considered a **non-response** and was so recorded by the facilitator on the "Data Entry Covering Form".

Only at the conclusion of the initial interview did the interviewer indicate that the respondent had been pre-selected for another short survey. Since only the "24 hour recall" was to be repeated and no other aspects of the survey, the second interview was estimated to take approximately 20-30 minutes. The interviewers were instructed **not** to inform the participant that the second survey was another "24 hour recall", as to not bias the respondent's food intake for the day to be recalled.

E. QUALITY CONTROL

The quality of the survey data was dependent on the quality of each individual form and therefore subject to bias. All completed survey forms were reviewed twice, to assure quality before the forms were forwarded to the quality control supervisor. First by the interviewer at the participant's home and second by the facilitator. The purpose of the first check was to identify and correct any errors or omissions before the forms left the area in which the participant resided. Errors identified by the interviewer or later by the facilitator, that could not be corrected by the interviewer herself, were noted and where necessary, the original interviewer telephoned the respondent to obtain or clarify the outstanding information. In this way, confidentiality was assured.

Quality control checks were to be completed within a few days of data collection (if possible) so that the interview and the foods eaten were still clear in the participant's and the interviewer's memory. If however, this was not possible the accuracy of the data collected may have been compromised (due to memory loss) increasing the potential for respondent bias. The interviewer was to submit the completed forms to the facilitator according to survey protocol and the facilitator was to report any outstanding questions or problems to the interviewer as soon as possible. Final corrections were to be entered on the form by the facilitator within three days of receiving the forms.

F. FORWARDING OF COMPLETED FORMS

The completed, checked surveys were forwarded to the Bureau of Nutritional Sciences, Health Protection Branch at Health Canada. All completed surveys were packaged together and delivered to the facilitators in person or by government courier. The facilitators were responsible for forwarding completed surveys each day to Alberta Health by courier. A computer generated "Batch Sheet" was prepared to accompany every box of completed survey packages sent to the BNS. The "Batch Sheet" listed all survey packages sent. It listed the five digits of the reference number for each survey package included. As each batch was received, it was checked to determine if the number of survey packages corresponded exactly to the "Batch Sheet". If there were more or fewer forms than indicated on the "Batch Sheet" a follow up was required.

G. DATA PROCESSING AND ANALYSIS

The data processing and analysis was jointly conducted by the Nutrition Research Division and the Biostatistics and Computer Applications Division. The CANDI nutrient database was updated to accommodate foods and recipes common to the province of Alberta. The processing of the nutrient intake data included expert validation of field level records, data entry of the records, manual and computerized verification of all food records and the calculation of nutrient intakes for each survey participant and for each age and sex group.

H. LIMITATIONS OF THE METHODOLOGIES EMPLOYED IN THE ANS

a) Interviewer errors: Anthropometric assessments were subject to observer bias and or subject bias as an inordinate amount of homes were carpeted, therefore requiring participants to self report height and or weight (Silman, 1995).

b) Data base errors: In the ANS differences were noted between the type and or amount of fat used among various restaurant establishments. These differences could possibly lead to various errors including misclassification of fat intake, coding errors or information bias (Gibson, 1990 and Silman, 1995).

c) Self reporting errors: Discrepancies between reported household income level and census data were reported (Silman, 1995).

I. NON-RESPONDENTS

For those selected persons who did not participate in the survey, the "Interviewee Profile", "Data Entry Covering Form" and "Record of Calls and Appointments" were to be completed, with as much information as possible, and forwarded along with other survey sets to the facilitator. The reference number was to be included on the "Data Control Form". A computer program was used to keep track of the response rate. The "Data Entry Covering Forms" for non-respondents were sent to the Bureau of Nutritional Sciences in Ottawa.

The greatest concern to investigators in any epidemiologic study, is that of non-response bias (Silman, 1995). The fundamental issue is whether or not those who chose to participate in the survey are selectively different from those who chose not to participate. In free living populations there will always be residents who decline to participate, and the likelihood that they will decline is usually higher among males, and is often related to socioeconomic status, particularly education level (Silman, 1995). In the ANS, it was originally estimated that 1,464 names would be sufficient to obtain approximately 1000 respondents each season. However, in season one, the non-response rate was higher than anticipated and only 794 interviews were granted. Therefore, in season two, one of the "reserve batch" of names was utilized to bring the combined survey total up to the projected target of 2000 respondents. There are a number of possible reasons why some Alberta residents may have chosen not to participate in the survey, such as lack of interest or personal relevance, inconvenience, avoidance of discomfort, cost (time from work or child care costs), anxiety about health and or aversion to research (Silman, 1995). A large non-response rate increases the probability of bias. To estimate the differences between the responders and non-responders, which are known to bias the results, it would have been ideal to ask those who refused, at the time of recruitment, some information about nutrition. Unfortunately, the ANS provided no supplemental information on the non-responders to examine these differences rigorously. So although it has been suggested that non-participation by residents in Alberta was not predictable and therefore most likely random (personal communication with Beth Junkins), non-response in the ANS does pose a problem of unknown magnitude. Therefore, inferences drawn from the ANS about the population of Alberta regarding nutrition and health should be made with caution.

In the ANS the non-respondents were statistically similar to the respondents regarding several sociodemographic characteristics, including age and sex, reported household income level, employment status and geographic location (Beth Junkins, personal communication). However, there are a number of inconsistencies between data from the ANS and data obtained from other Health Canada surveys on the same population. These include:

1) Marital Status [1]: There was significantly more males between 25-35 years of age (74%) that reported being married in the ANS than expected (59%).
2) Education Level [2]: Based on 1991 Statistics Canada census data, a significantly higher proportion of males and females in the ANS reported a bachelors degree or higher.
3) Smoking [3]: There were significantly fewer smokers between 25-34 years and 55-64 years, and significantly more smokers between 35-44 years in the ANS than expected. However, the overall proportion of smokers did not differ significantly from the anticipated proportion (26%).

J. DATA HANDLING AND PROCESSING AT THE BUREAU OF NUTRITIONAL SCIENCES (BNS), OTTAWA

The Nutrition Survey Section of BNS, which provided technical assistance to many aspects of survey planning and development, was also responsible for the handling and processing of all the data from survey forms sent to Ottawa.

The work involved:

1) tracking and control of all survey forms
2) data entry and verification
3) data processing and production of outputs

Each activity was undertaken with state-of-the-art computer systems. The main components included: a forms control and management system, the Canadian Nutrient File (CNF) database and CANDI, the operational software. The CANDI Program captured the data from the field forms, accessed the nutrient content of foods from the CNF, calculated intakes, compiled data and produced tabulations of the results. Statistical support systems within the Food Directorate were used in the final assessment of the data. Fax and telephone communication between BNS and Alberta were used to solve problems, correct errors and clarify inconsistencies relating to any information received in Ottawa. Questions concerning survey design, operations or implementation were channeled to the survey investigators; questions relating to recorded data were channeled to the survey supervisor.

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[1] Statistics Canada "The National Annual Demographic Statistics 1995", Catalogue 91-213-XPB, pg. 100-101

[2] Statistics Canada " The Nation Education Attainment and School Attendance 1991 Census", Catalogue 93-328, pg. 34-35

Research suggests that when computerized nutrient data bases are used, the computer program (Canadian Nutrient File) and the associated soft ware (CANDI) may introduce major sources of bias (Gibson, 1990). The CANDI system was updated to include nutrient information on products and restaurants specific to Alberta.

K. DATA MANAGEMENT

A computer program based on dBase IV was used to manage and track survey forms and to identify data on each individual selected for the survey. The program, developed by the principal investigator with computer expertise within the Food Directorate, was used to prepare, on an on going basis, tabulations of responses and non-responses according to various criteria. Input into the system began in Alberta and was completed and verified at BNS. Communication between the two locations was by floppy disk exchanged by mail, according to needs for updating and quality assurance. At BNS, batch sheets sent by fax were used to ensure that all courier deliveries were intact, and compared with survey packages as received, to confirm that all records had arrived. Basic identifying data entered in Alberta was confirmed and, if required, inconsistencies were clarified and additional information relating to data management in Ottawa was entered. A cumulative record of the status of all forms at either location was thus continuously available. At the close of the survey, this tracking system produced a variety of tabular outputs relating to response rates and the criteria used to define the sample.

L. CANADIAN NUTRIENT FILE

The Canadian Nutrient File (CNF)* is a computerized data base, compiled at BNS, on the nutrient values of foods. The primary source of the data involved extensive revisions of the U.S. Department of Agriculture's (USDA) Agriculture Handbook No. 8, adapted to reflect Canadian analytical data, enrichment and marketing practices in Canada. The CNF was continuously updated to include new and revised food composition data as they became available in Canada and from the USDA. The file contained data up to 78 nutrients in approximately 4,000 basic foods. The descriptors used to define foods in the CNF dictated the level of detail that must be recorded on the survey forms completed in

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[3] Statistics Canada "Survey on Smoking in Canada", *Cycle 2*, 1994

the field. *(Information on the CNF has been published in the Can. Diet Assoc. J. 1984;45:52-55, and 1987;48:21-23).

M. CANDI

CANDI is a custom-designed software program, developed by research staff at BNS, to facilitate the entry, processing, storage and retrieval of data from food consumption surveys, nutrition studies and a variety of related activities. The system is designed to be flexible for both input and output. Individual foods, meals, recipes, one-day or several-day records can be entered. Examples of information that can be obtained from the data include the frequency of intake of all foods, of one food, or of one food group and the nutrient intakes for individuals or for user-defined physiological, demographic or socioeconomic groups within survey populations. The system is flexible and user friendly but maximum efficiency demands that survey methodologies and form lay out are designed in close collaboration with those who can "tailor-make" the system for specific applications.

Custom designed displays were used in the entry of data from pre-coded survey forms. An automatic checking system demanded that such data was entered twice to ensure accuracy. Entry of data from the 24-hour recalls involved a user friendly mechanism for locating foods in the data base. In addition, approximately 3,000 existing recipes could be adapted and new recipes created so that recorded detail about foods consumed in Alberta could be captured. Amounts consumed were entered as weight or volume. CANDI then accessed the CNF and using these weights, calculated the nutrients provided in each food as it was entered into the system. It also called up a file on the vitamin and mineral content of all nutritional supplements registered with Health Canada.

N. DATA ENTRY

Data recorded on the survey forms were entered into CANDI by experienced staff familiar with food descriptions and the survey methodology. Professional staff advised and supervised the data entry staff on a day-to-day basis so that quality work was assured. Data from all forms except the 24-hour recall was entered twice. The system provided immediate on screen feedback of inconsistencies which were to be corrected before further entries could be made. An interactive process was used to enter the 24-hour recall data.

The operator entered a key name for a food and selected the exact or best match to the food or mixed dish from the many options displayed on the screen. Substitutions to ingredients could be made to computerized recipes or new recipes were created as required. Quantities consumed were entered by weight, volume or coded portion-size model. Nutrient supplement data was entered by the Drug Identification Number (DIN) or by the name and or nutrient content if a DIN was not available at the time of data entry. Problems and questions related to recorded data that were identified during data entry, were relayed to Alberta for clarification or correction before data entry was completed. Professional staff at BNS made a final manual data input check by comparing a printed copy of each individual's computer recorded data with the information on the original field form. Identified errors were immediately corrected and the final report filed.

O. DATA PROCESSING AND STATISTICAL SUPPORT

Data collected from questionnaires and records of 24-Hour Recalls for each participant were stored in individual computer files in the CANDI System. When entries were completed, the files were examined, checked and modified using custom computer programs to correct errors and ensure uniformity in coding of foods. Nutrient intakes and other parameters were finally calculated using the latest version of the data base. These data were collated in data base files with factors for the adjustment of data (sampling weights) as defined by Statistics Canada. The files were retained for the preparation of reports and later research. Tabulations for survey reports were prepared from the data files by staff of the Bureau of Biostatistics and Computer Applications Division of the Food Directorate at Health Canada.

P. 24 HOUR DIETARY RECALL

During the 24 hour dietary recall participants were asked to list the foods, beverages and or vitamin and mineral supplements that they consumed during the previous 24 hours. This method is useful in providing an estimate of current average intakes among large populations (Young, 1981). The strengths of using a 24 hour dietary recall include; employing a standardized interview protocol (to minimize interviewer bias), low respondent burden, high compliance, low cost, includes holidays, relatively minimal time constraints and this method can be used for illiterate individuals. The disadvantages to using a 24 hour recall include errors in memory, the time intensive task of coding and the potential for "flat slope syndrome". Flat slope syndrome describes the phenomena whereby individuals tend to overestimate low intakes and underestimate high intakes. According to Gersovitz et al., (1978), the flat slope syndrome may be an artifact of statistical analysis and a result of regression towards the mean. Moreover, the 24 hour recall method may have additional limitations when used with certain segments of the population. This method has been reported to underestimate average intakes among elderly participants (Campbell and Dodds, 1967; Madden et al., 1976).

Approximately 30% of respondents repeated the 24 hour recall. Using the test-retest method improves precision if the nutrient intakes obtained on the two separate occasions are similar. Lack of agreement does not necessarily reflect an imprecise method. It is possible that nutrient intakes may have changed as a result of usual daily variations in food intake. The adjustments for intra-individual variability have been done by Health Canada and are denoted as ALADJST X2A in the data dictionary. Due to the nature of the distribution, carotene, caffeine and alcohol had no adjustments done. These files would be most useful for assessing the distribution of usual intakes by age and sex at the population level (Beth Junkins, personal communication).

Q. FOOD FREQUENCY QUESTIONNAIRE

Food frequency questionnaires provide adjunct support to the 24 hour recall by providing a qualitative measure of usual intake at a fixed point in time. In the ANS, the food frequency questionnaire addressed issues such as season, food preparation methods and portion size. More specifically, the food frequency questionnaire was used to estimate low, medium and high fat consumption. The estimated intake of fresh fruits and fruit juices was used to predict (and or validate) vitamin C intake and select green vegetables and or carrots were used to predict carotenoid intake. Whole grains, vegetables and fruit, legumes and nuts were used to predict dietary fibre intake. Disadvantages include respondent burden to remember his or her usual intake and therefore, bias may be introduced by the respondent's perception of what constitutes a "good diet", and validity may be nutrient dependent (e.g. vitamin A). Therefore, the potential exists for mis-classifying respondents' estimated fat intake as either low, medium or high. This part of the questionnaire was developed by Health Canada to classify respondents' food intake by fat level. However, in the present study the food frequency questionnaire was used to estimate alcohol intake only. Gibson (1990) reports that studies on precision of the food frequency method are limited.

In addition, respondents were asked why they choose the foods they eat. For the purpose of the present study (chapter 8), this component of the survey was used to identify respondents who reported choosing or avoiding foods or types of foods because of a concern about cancer specifically. Respondents were also asked to report whether they were choosing or avoiding foods because of a concern about 1) health in general, 2) heart disease, 3) osteoporosis, 4) high blood pressure and or 5) weight gain.

R. ANTHROPOMETRIC ASSESSMENT

Survey interviewers measured height and weight with adherence to a standardized protocol. Weight and height measurements were to be performed in a room with wood or other hard surface flooring (without a baseboard) if possible. Weight was measured and recorded to the nearest 0.5 kg using a weigh scale that was calibrated daily. Persons were to remove shoes, heavy clothing (outdoor jackets), and empty pockets. Height was measured and recorded to the nearest 0.5 cm using a tape with lock and stainless steel foot plate. If interviewers were unable to obtain weight or height measurements (i.e. wheelchair), self reported height and weight were recorded in the unit of measure as reported by the individual. Moreover, not all participants in the Alberta population agreed to have their height and weight measured (refused), some participants self reported one or both of these values. The proportion of respondents in the ANS that agreed to have their height and or weight measured, who self reported their height and or weight or refused is pending further analysis. However, the proportion of respondents that agreed to have their height and or weight measured appears to be low.

The definition of obesity is controversial and changes from study to study and from time to time and an unknown measure of bias may be introduced depending on the method (clinical measurements vs self reported data) used for obtaining anthropometric measurements. These inconsistencies make it difficult to compare the prevalence of obesity among similar cohorts across studies. In a study comparing measured height and weight with self reported height and weight it was reported that women (but not men) under reported their weight by an average of 1.1 kg whereas, men and women over reported their height by an average of 1.4 cm and 0.7 cm; respectively (Roberts, 1995). In addition, age differences in height derived from cross-sectional studies may be further influenced by differential influences among various age cohorts. Sorkin et al (1999) reported that the rate of decrease in height is greater for women than for men and begins at about age 30 in both men and women, progressing with increasing age. Research also suggests that the under reporting of food intake among obese and non-obese women may further bias results making interpretation of the data suggesting an association between risk of disease and energy intake, obesity and or physical activity difficult (Poppitt et al., 1998).

S. NUTRITION, ACTIVITY AND HEALTH QUESTIONNAIRE

This component of the survey was used to ask respondents questions about nutrition, physical activity and health. There were four sections to this questionnaire. Part I included questions about sources of food and nutrition information. Part II included questions about physical activity during leisure time and at work. Part III included questions that related to general health and Part IV included questions about factors that might affect the food people eat (i.e. food insecurity). Parts I, II and IV are pending further analysis however, part III was used to identify respondents who reported smoking and how many cigarettes they smoked per day. The data from this questionnaire was not analyzed at the time of this study.

T. LITERATURE REVIEW

A comprehensive review of the literature was conducted using the MEDLINE database system (English language only) from 1966 to 2000. References from identified source articles published prior to 1966 were also reviewed. Articles were systematically and manually retrieved according to general search terms relating cancer, diet, nutrition and exercise. More detailed searches were conducted using the American Cancer Society's (1996) six published recommendations to reduce the dietary risk of cancer (see chapter II). Specific search terms included 1) obesity, 2) dietary fat, 3) dietary fibre, 4) antioxidants, 5) alcohol, 6) nitrites/salt. Related search terms included i.e. a) weight, b) polyunsaturated fatty acids, c) soluble fibre, d) vitamins and minerals, e) beer, wine and spirits, f) nitrosamines and salt. Reviewed journal articles included cross-sectional, case-control, prospective (cohort) and ecological studies. Experimental studies were used as supplementary sources. Only articles pertaining to adults (18 years +) were included.

The association between each recommendation and related search term and cancer risk was identified. Peer reviewed articles were collected that identified decreased cancer risk, increased cancer risk as well as no relationship of cancer risk for each recommendation and or related search term. Each article was assessed for appropriate methodology i.e.

I. Was the outcome measure appropriate?
II. Who was studied?
III. How many were studied?
IV. What was the method used to obtain information?
V. Was confounding and bias controlled for?
VI. Were the results generalizable or useful for comparison to the Alberta population?

I. The strength and consistency of each association between recommendation (and or related search term) and cancer risk was weighed. Where appropriate experimental data provided evidence of a proposed mechanism. Dietary sources (i.e. dietary fibre) and consumption patterns in the Canadian diet were identified using provincial and federal population health surveys (if available, data for Alberta residents was also included). Other relevant reference materials included Food, Nutrition and the Prevention of Cancer: a global perspective (1997)[4] and the Canadian Cancer Statistics (1997, 1999)[5]. The respective sociodemographic variables (i.e. reported household income level, educational attainment and employment status) associated with each recommendation (i.e. dietary fat) and related search term (i.e. polyunsaturated fatty acids) was documented. The evidence was summarized according to objective one (I.) as outlined in chapter I.

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[4] World Cancer Research Fund & American Institute for Cancer Research (1997)
[5] National Cancer Institute of Canada (1997, 1999)

U. STATISTICAL ANALYSIS

Unless otherwise stated all data is presented as mean ± standard deviation and includes the median (or 50th percentile), minimum and maximum intake. The specific nutrients calculated in the analysis included:

I. total kilo-calories;

II. total dietary fat, percent energy from total fat, saturated fat, polyunsaturated fat, monounsaturated fat; polyunsaturated: saturated fat ratio (P/S), linoleic acid, linolenic acid, omega 6:omega 3 ratio, cholesterol, cholesterol per 1000 kilo-calories; report excludes median intake as similar to estimated mean intake;

III. total dietary fibre, dietary fibre per 1000 kilo-calories;

IV. vitamin A, carotenoids and vitamin C;

V. salt;

VI. dietary folate, thiamin and riboflavin;

VII. total daily alcohol, drinks per week, beer, wine and spirits per week

Where appropriate, nutrient intake data was compared to the Recommended Nutrient Intake (RNI), the Nutrition Canada Recommendations or the American Cancer Society's (1996) recommendations regarding dietary fibre intake. The proportion of residents not meeting their respective RNI or recommendation was calculated.

With the exception of alcohol, all estimated mean nutrient intakes were calculated using the 24 hour dietary recall records. Alcohol consumption was calculated using the food frequency questionnaire. It should be noted that the American Cancer Society (1996) defines an alcoholic beverage as 12 ounces of regular beer (1 bottle), 5 ounces of table wine or 1.5 ounces of 80 proof distilled spirits. In the ANS (1994) alcohol consumption was defined as 12 ounces of regular beer, 4 ounces of table wine and 1 ounce of distilled spirits. Alcohol consumption was estimated by multiplying the frequency response by the alcohol content of the specified portion sizes. It is assumed that 12 ounces of beer (360 ml) contains approximately 12.8 grams (g) of ethanol, 4 ounces of wine (120 ml) contains 11.0 g and 1.5 ounces (45 ml) of 80 proof distilled spirits contains 14.0 g of ethanol (Zhang et al., 1999).

All statistical analyses were performed using SAS Version 6.11 (SAS Institute, Cary, NC). One way analysis of variance (ANOVA) was used to determine the effect of age and sex (8 categories) on the estimated intake of total energy, dietary fat, dietary fibre, antioxidants, minerals, alcohol and salt. Analysis of variance was used to determine the effect of marital status (3 categories), education level (5 categories), reported household income level (7 categories), employment status (3 categories) and smoking (2 categories); differences ($p < 0.05$) between group means were identified by the Duncan's Multiple Range Test. Chi-square analysis (X^2) was used to identify the proportion of Alberta residents whose dietary intake patterns was consistent with the American Cancer Society's (1996) recommendations to reduce the age specific incidence rate of cancer. Chi-square analysis (X^2) was also used to identify the proportion of Alberta residents who reported choosing or avoiding foods or types of foods because of various health related reasons.

V. BONFERRONI METHOD[6, 7]

The Bonferroni is a post hoc adjustment procedure. The Bonferroni method adjusts the alpha level downward to reduce the probability of a type I error (the chance researchers take of incorrectly declaring a difference, relationship or effect), due to repeated testing. The alpha level is commonly set at 0.05. At this level there is a possibility that one in twenty statistical tests will demonstrate "statistical significance", while in fact this is not so. Conducting more than one statistical test increases the probability of finding at least one test "statistically significant" due to chance alone. For example, in five tests the probability of finding at least one difference, relationship or effect significant due to chance is one in five or 0.20. However, performing ten tests increases the probability of a type I error occurring to approximately one in two or 0.40. In other words, performing more tests increases the probability of finding statistical significance due to chance alone. The Bonferroni method adjusts the alpha level of each test downward to ensure that the overall risk for a number of tests remains 0.05. Therefore, even if more than one test is performed the risk of incorrectly declaring a difference, relationship or effect continues to be one in twenty.

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[6] http://home.clara.net/sisa/bonhlp.htm

[7] http://sghms.ac.uk/phs/staff/jmb/bonf.htm

The limitation of applying the Bonferroni method is that by reducing the probability of a type I error (or rejection error) on an individual test, the chance of making a type II error (or acceptance error) is increased. A type II error is the chance researchers take of declaring that no difference, relationship or effect exists, while in fact there is a difference, relationship or effect. For this reason, the Bonferroni method has been criticized for being too conservative, leading to p values that are too high and confidence intervals that are too wide. Therefore, the Bonferroni method is not suggested for use when there are five or more groups. The Bonferroni method was therefore not applied to hypotheses that tested for the effect of age and sex (8 groups), household income level (7 groups) and education level (5 group) in the present study. Moreover, the Bonferroni method is not suggested for use when there is multiple testing among more than two groups of subjects and each group is compared for relationships between several variables. In addition, the Bonferroni method is not suggested for use among multiple tests that are highly correlated (i.e. smoking and alcohol consumption).

In the ANS the Bonferroni method was applied only to hypotheses in which there were less than five groups, and included the effect of marital status (3 groups) ($p < 0.0167$), employment status (3 groups) ($p < 0.0167$) and smoking (2 groups) ($p < 0.025$). For marital status, employment status and smoking the actual p value was stated. Applying the Bonferroni procedure identified the potential for type I error in three tests of marital status (carotenoid intake among males, weekly alcohol intake and body mass index among females), and six tests of employment status (total fat intake among females, linoleic acid intake among males, weekly beer intake and daily alcohol intake among females and weekly wine intake among males and females). These tables were therefore removed from the body of the thesis to Appendix A. The Bonferroni method did not suggest a type I error among any tests for smoking among males and females.

The Bonferroni method reduces the possibility of attaching too much importance to a single significant result when other results are non-significant (i.e. low carotenoid intake among separated, divorced and widowed males). It has been suggested that if the

Bonferroni method identifies no difference, relationship or effect overall (i.e. total fat intake), then significant differences among subgroups (i.e. linolenic acid intake) should be interpreted with caution.

W. WEIGHED DATA

Where chi-square analysis was calculated un-weighted data was used. The use of sample weights and or population weights would have been inappropriate for chi-square analysis as applying a weight to proportions may introduce bias in the direction of the weighting applied. Probability weights are the inverse of the probabilities of inclusion of respondents in the sample and were calculated from the sample design (Alberta Heart Health Survey, 1990). Sample weights were applied to the estimated nutrient intakes. Sampling weights take into account the initial probability of being sampled, the non-response and post-stratified to correct for under-representation or over-representation of the sampling frame (e.g. marital status, education level and smoking). When applied, these weights ensure that the results of the 2,039 respondents are weighted to reflect the age-sex-location profile of the population. The sample weights ensure that the number of respondents equals the number surveyed (2,039). The population weights ensure that the number of respondents add up to the total age-sex population under investigation for the entire province (according to the most appropriate census data), and is rounded to the nearest integer. When non-response bias is an issue (as in the ANS because only 75% of the population were sampled) applying sample weights increases the probability of a Type I error (to reject the null hypothesis when it is true). If the sample respondents skipping questions (i.e. anthropometric measurements) is biased the probability can increase significantly, making it difficult to model the data and ensure that statements about statistical significance are valid. Therefore, caution during data interpretation is warranted as non-response is an issue and the magnitude of a Type I error is unknown.

X. OTHER REPORTED SOURCES OF ERROR AND RECORDED LIMITATIONS (FROM FIELD NOTES)

Some respondents were more likely to consider how densely they salted foods rather than using whole or part amounts of the circle model to reflect estimated salt intake. Conversely, other respondents used the circle as a dimension instead of focusing on the density of the salted area within the circle model. Overall, field notes suggest that few people reported added salt during cooking.

Y. ETHICAL APPROVAL

The present study received ethical approval from the University of Alberta, Faculty of Agriculture, Forestry, and Home Economics Human Ethics Review Committee.

CHAPTER FOUR

I. INTRODUCTION

A. DIETARY FAT

The American Cancer Society (1996) recommends that consumption of dietary fat be reduced to 30% or less of total caloric intake.

a) Literature Review

In a review by the American Institute for Cancer Research (1997) it was concluded that dietary fat may increase the risk of cancer at several sites. Positive correlations have been observed between consumption of diets high in fat and cancer incidence and attendant mortality rates at sites including the breast, prostate, colon, rectum, ovary and pancreas (Carroll et al., 1968). However, contradicting evidence (Higginson and Sheridan, 1991; Willett, 1997) has also been reported indicating that dietary fat may have no effect on colon cancer and may be inversely associated with the risk of breast or stomach cancer. In 1975, Berg proposed that several of the cancers prevalent in the United States may be due to high caloric intake rather than fat intake, as energy intake relates positively to diets high in fat (Committee on Diet, Nutrition and Cancer, 1982). Evidence obtained from experimental models and an international correlation study supports the role of excess energy in the etiology of cancer (Armstrong and Doll, 1975).

Research suggests that there is a possible inverse relationship between the intake of fat (as a proportion of total energy intake) and consumption of vegetables and fruit (Ziegler et al., 1992). Moreover, diets higher in total fat may be associated with obesity (Royal College of Physicians, 1983), and or sedentary lifestyle and diets containing proportionately less food from plant based sources (AICR, 1997). Therefore, diets high in fat may represent a proxy for other factors associated with risk of cancer.

b) Fatty Acid Composition

Polyunsaturated fatty acids obtained from a variety of dietary sources have been extensively studied using animal models to better elucidate potential mechanisms in the carcinogenic process. Overall, evidence suggests that polyunsaturated fatty acids from vegetable oils promote carcinogenesis in animal models whereas saturated fatty acids and polyunsaturated fatty acids from fish oils either exert little effect on carcinogenesis or are inhibitory in nature (Carroll, 1987; Karmali, 1989; Cave, 1991; Simopoulos, 1991). Further studies using animal models have attempted to determine the association between the types of polyunsaturated fat in the diet and cancer risk at various sites. Data obtained from animal models suggest that diets composed predominantly of omega 3 fatty acids suppress tumorigenesis compared with diets consisting primarily of omega 6 fatty acids (Carroll, 1987; Karmali, 1989; Cave, 1991; Simopoulos, 1991). However, previous investigations using experimental models focused on diets consisting of individual fats and oils and therefore may not have been representative of the variable fat composition inherent in human diets.

Subsequent studies have since investigated the tumor promoting effects of diets containing a combination of omega 6 and omega 3 polyunsaturated fatty acids on tumorigenesis. In a review of the data, Cave (1991) has suggested that a low level of dietary omega 3 fatty acids (18:3 ω-3 α linolenic acid) may not have a detectable suppresser effect on mammary tumor growth in experimental models when accompanied by sufficient dietary omega 6 fatty acids (18:2 ω-6 linoleic acid). However, when the proportion of dietary omega 3 fatty acids exceeds the level of omega 6 fatty acids in the diet, an inhibitory effect of omega 3 fatty acids on tumorigenesis has been observed. Therefore, it has been suggested that the ratio of omega 6 to omega 3 fatty acids in the diet may influence the role of polyunsaturated fatty acids on tumor promotion relative to the absolute amount of fatty acids in the diet (Dolecek, 1992). Currently, the optimal omega 6:omega 3 fatty acid balance in the diet has not been established.

There are several possible mechanisms by which the type of fatty acid in the diet might alter the cancer process. Linoleic acid (18:2 ω-6), obtained primarily from vegetable sources, is a precursor for prostaglandin synthesis (Hunt and Groff, 1990), a group of biologically active cellular mediators and related compounds collectively referred to as eicosanoids. Data obtained from experimental models suggest linoleic acid has tumor promoting effects that may be partly mediated through eicosanoid production (Carroll et al., 1986). Inhibitors of prostaglandin biosynthesis have been shown to oppose the promoting effects of dietary fat on tumorigenesis (Abraham and Hillyard, 1983; Carter et al., 1983). There is evidence suggesting that saturated fat may influence the initiation stage of tumorigenesis in experimental models (Carroll, 1980) whereas polyunsaturated fat such as linoleic acid may exert its tumorigenic effects during the promotional phase (Carroll et al., 1968). Eicosapentaenoic acid (20:5 ω 3), derived from linolenic acid (18:3 ω 3) in fish oils, can inhibit the formation of prostaglandins. In addition, eicosapentaenoic acid (EPA) is not converted to physiologically active eicosanoids in significant amounts (Granstrom et al., 1983). Eicosapentaenoic acid and docosahexanoic acid favorably compete with arachidonic acid for the cyclo-oxygenase enzyme to produce different eicosanoids (Nutrition Recommendations, 1990). These (DHA and EPA) omega 3 fatty acids are capable of inhibiting the production of eicosanoids derived from arachidonic acid (20:4 ω 6) and have been demonstrated to reduce or prevent tumor growth in rodents (Simopoulos, 1999).

Dietary fat from a variety of sources play diverse roles in the lipid metabolism of humans. Overall, evidence from experimental and epidemiologic studies suggest that both quantitative and qualitative factors may influence the association between consumption of dietary fat and risk of cancer at some sites. Consumption of dietary fat, from a variety of sources, can induce structural and functional changes in the composition of lipid membranes and interact with other dietary constituents, such as dietary fiber, to alter cancer risk.

To reduce the age specific incidence rate of cancer it is therefore suggested that the consumption of total dietary fat be reduced to 30% or less of total caloric intake (33 grams/1000 kcal). It is further suggested that the intake of saturated fat account for no more than 10% of total energy intake (11 grams/1000 kcal). Reducing total dietary fat and fat intake from animal sources will likely reduce the consumption of cholesterol in the diet as well. Dolecek (1992) has reported that the ratio of ω 6: ω 3 polyunsaturated fatty acids in the diet has a significant inverse relationship with cancer mortality. The optimum ratio of linoleic acid (18:2 ω 6):linolenic acid (18:3 ω 3) has not been established. Due to the different affinities of these essential fatty acids for the metabolism and subsequent incorporation into lipid membranes, in Canada it is suggested that ω 6: ω 3 fatty acids be consumed in amounts that range between 4:1 to 10:1 or account for 3% and 0.5% of total energy intake; respectively (Nutrition Recommendations, 1990). Currently, it is estimated that the consumption of essential fatty acids range between 10:1 to an estimated 20-25:1; ratios which may compromise the utilization and incorporation of essential ω 3 fatty acids obtained from the diet (Simopoulos, 1991). In addition, it has been suggested that the P/S ratio be at a ratio approaching 1.0 to improve health.

c) Dietary Cholesterol

Evidence obtained from earlier studies suggest that the consumption of dietary cholesterol may increase the risk of breast and colon cancer however, estimated risks were considerably lower than the risks estimated for total or saturated fat, and therefore, were largely disregarded (Miller et al., 1978; Jain et al., 1980). The potential role of dietary cholesterol in enhancing tumorigenesis however, cannot be overlooked as the etiology of cancer at different sites may have a distinct pathology. For example, a case control study conducted in Australia has provided evidence suggesting that dietary cholesterol may significantly increase the risk of developing cancer of the pancreas. After adjustment for total energy intake, alcohol and tobacco usage, the estimated relative risk for the highest quartile of cholesterol intake versus the lowest quartile was 3.19 (95% CI 1.58-6.47) (Baghurst et al., 1991), suggesting cholesterol intake may be associated with the development of pancreatic cancer.

B. DIETARY FIBRE

The American Cancer Society (1996) recommends consuming more high fibre foods such as fruits, vegetables and whole grain cereals.

a) Literature Review

Data obtained from animal and epidemiological studies have provided equivocal evidence suggesting that diets high in fibre reduce the risk of several chronic diseases (Bingham, 1990). More specifically, dietary fibre or specific components of dietary fibre are thought to be important in reducing the risk of developing cancer (Miller, 1994). Cancers of particular relevance include esophageal, stomach, colorectal and breast cancer (Miller, 1994). Several studies using animal models have been conducted to determine the role of different types and amounts of dietary fibre in colon cancer (Reddy, 1986; Reddy et al., 1980; Barnes et al., 1983). Discrepant findings between estimated consumption of dietary fibre and mortality from cancer in humans may partly reflect the lack of consistent methodologies used between studies. Methods used to assess the preventive effects of dietary fibre have undergone marked changes in the past decade, without any final conclusion as to what constitutes dietary fibre, or those components of dietary fibre that are related to preventing cancer (Miller, 1994). Dietary fibre has a complex and highly variable composition (Ferguson, 1993). Therefore, inconclusive interpretations of the data may be because the term dietary fibre includes a range of such diverse substances that some may offer protection while others may not (Ferguson, 1993).

Some of the ambiguity with data interpretation may be because dietary fibre is poorly defined. The term "dietary fibre" first originated as a shorthand term used by Hipsley in 1953 (Burkitt and Trowell, 1975) and since then several definitions of dietary fibre have evolved. Dietary fibre can be defined by its chemical or structural nature yet it can also be defined by its source, which concentrates more on the physiological effects of fibre and less on its chemical identity (Trowell et al., 1985). Generally, dietary fibre is defined as the components of plant tissues in the diet that are resistant to digestion by enzymes produced by humans (Harris and Ferguson, 1993). Dietary fibre or fibre fractions can be more practically classified into two major categories: water soluble or water insoluble (Anderson, 1985). Pectins and mucilages are water soluble and the main dietary sources include fruit, vegetables and oat bran (Slavin et al., 1997). Insoluble fibre fractions contain more cellulose and hemicellulose components and although they are also present in vegetables and fruit, they are more predominant in cereals, in particular wheat bran (Slavin et al., 1997). Comparison of dietary fibre content of various whole grains indicate that oats, rye, and barley contain approximately one-third soluble fibre while the remaining portion contains insoluble fibre (Slavin et al., 1997). In the colon, soluble fibre is largely fermented by the intestinal microflora. The insoluble fibre fractions are much less fermentable (Slavin et al., 1997).

Often, nutrition studies focus on nutrients rather than foods, food groups or overall dietary patterns. Recent epidemiologic studies have found that the consumption of vegetables and fruit is associated with a reduced risk of chronic disease (Steinmetz and Potter, 1991; Block et al., 1992) as are whole grains (Jacobs et al., 1995). Whole grains contain hundreds of nutrients and phytochemicals, some of which are also present in vegetables and fruit, which suggest that a combination of nutrients in these food groups may act synergistically to confer protective effects on reducing the development of chronic disease, such as cancer. Overall, structure is similar for all grains. However, grains consumed in developed countries are generally subjected to some type of processing. Furthermore, commercially prepared cereal products are usually altered in some way to make a more desirable product. Except for rice, grains are generally high in dietary fibre, low in fat, concentrated sources of starch, contain approximately 10-15% protein, are high in vitamins, especially B vitamins, and are good sources of minerals, particularly trace minerals. Other components of whole grains have been associated with health benefits, including tocotrienols, lignans, phytoestrogens, phenolic compounds, and phytic acid (Thompson, 1992).

C. EPIDEMIOLOGIC DATA INVESTIGATING ROLE OF DIETARY FAT AND FIBRE

There are many epidemiologic studies that have investigated the association between nutrition and cancer incidence and mortality rates. Furthermore, several factors other than dietary fat and fibre may differ between countries, and are not always possible to control for in ecological studies (Byers, 1994). Several studies suggest that rates of cancer incidence, at several sites, increases among migrant populations from low risk to high risk regions where the estimated consumption of dietary fat is relatively high and the consumption of dietary fibre, is relatively low (Young In, 1996; Haenszel et al., 1973; Jensen, 1986).

In countries such as Finland and the United States, where fat consumption is estimated to be greater than 30% of total energy intake, the risk of breast cancer among women from Finland is lower compared with the risk of breast cancer among women from the United States (Reddy et al., 1978; Jensen et al., 1982; Lanza et al., 1987). Research suggests that the consumption of a diet high in fat (greater than 30% of total energy intake) and low in dietary fiber (less than 20 grams per day) may act synergistically to increase the risk of developing cancer. In Finland the consumption of dietary fiber is reported to be greater than 30 grams/day, compared with an estimated average consumption of 11 grams/day in the United States (Reddy et al., 1978; Jensen et al., 1982;

Lanza et al., 1987). The importance of dietary fat in relation to total dietary fibre intake relative to incidence of cancer should be better recognized (Tsuji et al., 1996). Although diets high in energy (total calories) often contain proportionately higher amounts of fat relative to diets with lower energy contents (total calories) studies suggest a possible protective effect of dietary fibre when consumed in higher amounts relative to dietary fat in attenuating the risk of developing cancer, particularly cancers of the breast and colorectal region.

D. POSSIBLE MECHANISMS ASSOCIATING DIETARY FAT AND FIBRE INTAKE WITH CANCER

In 1971, Hill and Aries first associated fecal steroid composition with colon cancer and specifically identified bile acids as possible co-carcinogens or promoters in the process of colon cancer carcinogenesis. One possible explanation is that dietary fat increases bile acid excretion therefore increasing exposure of the bowel mucosa to possibly toxic, trophic and promoting effects (Hill and Aries, 1971). Estrogens are excreted in the intestine through the bile in the form of sulphates and glucuronides. Therefore, a diet high in fat (greater than 30% of total energy intake) and low in fibre (less than 20 grams per day) would increase the activity of bacterial beta-glucuronidase, an enzyme that allows fecal estrogens to be reabsorbed. Additionally, several other mechanisms for the anti-cancer effects of fibre have been proposed (Table 4.1).

Table 4.1 Possible Mechanisms of Dietary Fibre on Carcinogenesis

Proposed Mechanism	Possible Effect	Reference
Increases fecal bulk	Dilutes concentration of carcinogens	Greenwald, 1992
Alters bacterial composition in colon	Deactivates carcinogenic metabolites & hinders binding of carcinogens, cocarcinogens and/or promoters	Greenwald, 1992
Promotes structural or functional changes in intestinal mucosa	Alters rates of cell proliferation	Greenwald, 1992
Accelerates transit time	Reduces contact of carcinogens	Greenwald, 1992
Lowers anaerobic fecal flora associated with high fat diet	Decreases primary and secondary bile acids	Wargovich and Levin 1996
Directly binds unconjugated estrogens	Reduces enterohepatic circulation of estrogens	Shultz and Howie, 1986
Generates short chain fatty acids (particularly butyrate)	Decreases colonic pH, affects colonocyte growth, differentiation and gene expression (antineoplastic)	Velazquez, 1996

E. DIETARY FAT CONSUMPTION AMONG CANADIANS

In Canada, recent health surveys suggest that total dietary fat intakes among Canadians exceed the recommended level of no more than 30% of total caloric intake (Table 4.2).

Table 4.2 Canadian Health Surveys and Estimated Dietary Fat Intake

Study Population	Year	Sample Size (N)	Age (Years)	Mean Relative Dietary Fat Intake (% of Total Energy)
Nova Scotia	1990	3,204	18 to 74	35%
Manitoba	1993	2,115	18 to 74	38%
Montreal	1995	301	18 to 65	35%

(Nova Scotia Nutrition Survey, 1990; Manitoba Nutrition Survey,1993; Nolan, et al., 1995)

Evidence suggests that Canadian women between 65 and 74 years of age consume proportionately less dietary fat than any other group while men between 18 and 34 years of age have been reported as consuming the highest percentage of energy from dietary fat (Nova Scotia Nutrition Survey, 1990; Manitoba Nutrition Survey, 1993; Ontario Health Survey, 1990). Most studies have concluded that the majority of Canadians are consuming greater than 30% of estimated total energy intake from dietary fat, regardless of demographic and socioeconomic status (Nova Scotia Nutrition Survey, 1990; Manitoba Nutrition Survey, 1993; Ontario Health Survey, 1990). Higher dietary fat intakes and lower dietary fiber intakes have been reported among lower socioeconomic status groups compared to higher status groups in Australia (Baghurst et al., 1990; Smith and Baghurst, 1992) and the United States (Kushi et al., 1988).

Results from the Tracking Nutrition Trends Survey (1996) indicate that concern about nutrition related topics, such as dietary fat and cholesterol has increased since 1989. However, approximately 72% of Canadians reported that they were unaware of the term omega 3 fatty acids (Reid, 1996). Approximately 69% of respondents incorrectly agreed that "the amount of cholesterol people eat is the major factor that affects their blood cholesterol", compared to 73% of respondents who incorrectly agreed with this statement in 1989 (Reid, 1996). Only 50% of respondents correctly agreed that "margarine contains the same amount of fat as butter" (Reid, 1996). In 1994, significantly ($p < 0.05$) more respondents (82% of N = 1902) reported being concerned about dietary fat compared with 71% of respondents in 1989 (N =1855) (Reid, 1996). Among the respondents who indicated concern about dietary fat, saturated fat and cholesterol consumption, the respective actions reported to reduce consumption of dietary fat appear in Table 4.3.

Table 4.3 Actions Reported to Reduce Consumption of Dietary Fat

	% Respondents	
Concerned About Dietary Fat	1989• (N =1440)	1994 (N =1601)
Buy/Eat lower fat products	28	47*
Use lean meats	22	25
Trim fat off meat	26	22*
Don't fry/Use no stick pan	-	15
Eat fewer fried foods	-	11
Use less butter/margarine	8	12*
Read labels	2	12*
Substitute chicken or fish	9	11
Concerned About Cholesterol	1989• (N=1204)	1994 (N=1340)
Fewer/no eggs	23	20
Read labels	3	16*
Use low cholesterol spreads	<1	12*
Exercise/Watch weight	11	12
Use lean meats	6	10*

- statistically significant difference ($p < 0.05$) from 1989
- responses were grouped differently in 1989• and 1994

In 1994, significantly ($p < 0.05$) more Canadians reported that they were likely to further reduce their consumption of dietary fat compared with respondents in 1989, especially Canadians 55 years of age and older (Reid, 1996). Among respondents who reported they were not likely to further reduce their intake of dietary fat (51%), 66% reported they were already taking measures to reduce their fat intake, while 16% "saw no need" and 14% reported not worrying/not caring about their dietary fat consumption (Reid, 1996). In the National Population Health Survey (1996) the steps Canadians reported taking to decrease the amount of fat consumed in foods appears in Table 4.4.

Table 4.4 Steps Reported Among Canadians to Reduce Consumption of Dietary Fat

Reported Steps to Reduce Dietary Fat Consumption	Men	Women
Using less butter, oil or salad dressings	75%	84%
Reducing intake of high fat milk products	68%	73%
Consuming less fried or deep fried foods	78%	82%
Consuming fewer snacks i.e.) chips and chocolate bars	61%	65%
Using lower fat milk products	64%	70%
Consuming leaner meats, poultry and fish	80%	79%
Choosing foods with lower fat contents	58%	64%
Baking, broiling or microwaving food	55%	63%
Reducing intake of nuts and seeds	NM	NM
Consuming meat alternatives	NM	NM

- Proportion not measured (NM)

In general, women were more likely than men to report taking each of the specific steps listed above to reduce their consumption of total dietary fat (National Population Health Survey, 1996). Among Canadians taking steps to reduce the amount of fat consumed in foods 79% of men and 81% of women said that they found it easy to do so (National Population Health Survey, 1996). However, reducing consumption of meat in favor of consuming more meat alternatives has been reported as the least favorable of all dietary changes (Lloyd et al., 1993). Furthermore, evidence suggests that respondents do not always recognize the dietary changes recommended as part of reducing consumption of dietary fat (Lloyd et al., 1993). The reported attitudes and beliefs about low fat food items among Canadians is listed in Table 4.5.

Table 4.5 Canadians' Reported Attitudes and Beliefs Regarding Low Fat Foods by Gender

Beliefs About Low Fat Food Choices	Men	Women
Low fat foods are readily available	78%	80%
Low fat foods are easy to prepare	59%	70%
Food labels indicate fat content	63%	66%
Low fat foods taste good	52%	62%
Low fat foods are expensive	33%	38%

In general, a higher proportion of Canadian women held these beliefs regarding low fat food choices compared to Canadian men (National Population Health Survey, 1996). The proportion of Canadians in agreement with each of these statements increased as reported income increased, with the exception of the belief that "low fat foods are expensive" (National Population Health Survey, 1996).

F. DIETARY FIBRE CONSUMPTION AMONG CANADIANS

Unlike the association between cancer and particular types of dietary fat, which may act to either promote or suppress tumorigenesis, no specific daily dose has been made regarding the types of dietary fibre (soluble vs insoluble) in reducing the incidence rate of cancer. It is suggested that populations aim for a daily dietary fibre intake between 20-30 grams from a variety of sources (American Cancer Society, 1996). A study of National Health and Nutrition Examination Survey II (NHANES II) data (1976-1980) indicated that only 16% of those surveyed reported consumption of breads and cereals high in dietary fibre on that day (Patterson and Block, 1988). Bingham and Cummings (1980) estimate that availability of total dietary fibre fell from 40 grams/day per capita between 1909-1913 to 26 grams/day in 1980. They attributed this decline in dietary fibre intake to a decreased consumption of whole grains (Bingham and Cummings, 1980). Although it is relatively simple to count servings of vegetables and fruit it is more difficult to determine the number of servings of whole grains. For example, not all brown breads are whole grain, making it difficult to distinguish whole grains from refined grains in nutrition surveys (Slavin et al, 1997).

Compared with the proportion of respondents in 1989 (N =1855) significantly ($p < 0.05$) more Canadians in 1994 (N =1902) expressed concern regarding dietary fibre intake (Reid et al., 1996). Among all regions combined, Canadians between 35-54 years (41%) of age reported consuming significantly ($p < 0.05$) more vegetables and fruit compared to Canadians between 18-34 years (36%) and 55 years and older (36%) (Reid et al., 1996). The reported actions taken by Canadians to increase their consumption of dietary fibre appears in Table 4.6.

Table 4.6 Primary Actions Taken Due to Concern About Fibre

Respondent's Actions	% Respondents	
	1989	1994
Concerned About Fibre	N = 1364	N = 1390
Eat more bran/high fibre cereals, muffins	35	61*
Eat more whole grain bread	30	42*
Eat more fresh fruit, vegetables	48	42*
* Significant difference ($p <0.05$) from 1989		

Reid et al.,1996

In 1994, among Canadians who reported they were not too likely (38%) or not likely at all (23%) to increase their intake of dietary fibre, 61% reported they were already increasing their fibre intake, while 19% reported they saw no need (Reid et al., 1996). Furthermore, 12% of Canadian respondents indicated that they did not worry or did not care about the amount of fibre they consumed (Reid et al., 1996). Among Canadians who reported taking active steps towards increasing their dietary fibre intake in the National Population Health Survey (1996), more than half reported taking four or more of the following six steps listed:

- eating vegetables or fruit at most meals, snacks
- using meat alternatives
- eating meals which have less meat
- eating whole grain products
- using whole wheat flour and bran in baking
- choosing foods that are high in fibre

In the National Population Health Survey (1996) approximately 2 million Canadian women (17.6%) and 1.8 million men (15.7%) expressed the belief that Grain Products "are too expensive". In addition, more than one in five (22.9%) who expressed this belief were Canadians over 65 years of age (National Population Health Survey, 1996). Among Canadians who expressed Grain Products "are too expensive" 27.3% were in the lowest income category, compared to 8.4% of Canadians in the highest income category (National Population Health Survey, 1996). In addition, 1.5 million women (12.3%) and 1.3 million men (11.4%) reported feeling that Grain Products "do not taste good" (National Population Health Survey, 1996). Among those with the perception that Grain Products "do not taste good" approximately 16.4% and 7.9% were in the lowest and highest income categories; respectively (National Population Health Survey, 1996).

II. RESULTS

A. Estimated Dietary Fat Intake

1. Effect of Age and Sex on Total Fat Intake

Males between 18-34 years were found to have a mean intake of fat that was significantly ($p < 0.05$) higher than that for any other age gender group (Table 4.7). Among males the estimated mean intake of dietary fat decreased significantly ($p < 0.05$)

with increasing age. Females between 50-64 years and 65-74 years consumed significantly ($p < 0.05$) lower mean estimated intakes of dietary fat. Among Alberta residents who expressed a concern about cancer, the mean estimated intake of total dietary fat was lower compared to the general Alberta population in all age gender groups with the exception of males between 18-49 years and females between 35-49 years. The maximum amount of energy derived from total dietary fat ranged from approximately 1,467 calories among females between 50-64 years to approximately 4,869 calories among males between 18-34 years (Table 4.7 appears at end of chapter 4).

2. Effect of Employment Status on Total Fat Intake

Unemployment (or student) status was associated with significantly ($p = 0.0231$) higher mean estimated intakes of total fat among males compared to individuals who reported full-time employment or part-time employment (self-employment, or retirement) status (Table 4.8 appears at end of chapter 4).

3. Effect of Smoking on Total Fat Intake

Male and female smokers consumed significantly ($p = 0.0010$) ($p = 0.0241$) higher intakes of dietary fat on average compared to non-smokers (Table 4.9 & 4.10). Smokers consumed approximately 6 grams more dietary fat per day than non-smokers (Table 4.9 & 4.10 appear at end of chapter 4).

4. Other Factors and their Relationship to Total Fat Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment or employment status on the average dietary fat intake among males and or females in the Alberta population (Appendix A Tables 1-6).

B. Effect of Concern About Dietary Fat

1. Total Fat

The proportion of Alberta residents who reported "avoiding foods or types of foods because of the fat content" ranged from 39% of males between 18-34 years to approximately 73% of females between 50-64 years (Table 4.11). Males and females between 18-34 years and females between 35-49 years who reported "avoiding foods or types of foods because of the fat content" consumed significantly ($p < 0.05$) less mean dietary fat compared to residents who did not report avoiding foods or types of foods because of the fat content. Males between 18-34 years who did not report avoiding foods or types of foods because of the fat content consumed approximately 27 grams (or 24%) more dietary fat than respondents who "reported avoiding foods or types of foods because of the fat content". The estimated mean dietary fat intake among females 50-64 years and 65-74 years who reported "avoiding foods or types of foods because of the fat content" was not significantly different among respondents who did not report "avoiding foods or types of foods because of the fat content" (Table 4.11 appears at end of chapter 4).

2. Saturated Fat

The proportion of Alberta residents who reported "avoiding foods or types of foods because of the saturated fat content" ranged from 19% of males between 18-34 years to approximately 60% of females between 50-64 years (Table 4.12). Males between 35-49 years and 50-64 years and females between 18-34 years and 35-49 years who reported "avoiding foods or types of foods because of the saturated fat content" consumed significantly ($p < 0.05$) less mean saturated fat compared to residents who did not report "avoiding foods or types of foods because of the saturated fat content" (Table 4.12). Females between 50-64 years and 65-74 years were more likely to report "avoiding foods or types of foods because of the saturated fat content", yet their estimated mean intake of saturated fat was not significantly ($p > 0.05$) different among respondents who did not report "avoiding foods or types of foods because of the saturated fat content" (Table 4.12 appears at end of chapter 4).

3. Unsaturated Fat

The proportion of Alberta residents who reported "choosing to eat foods or types of foods because of the unsaturated fat content" ranged from 22% of males between 18-34 years to approximately 59% of females between 50-64 years (Table 4.13). The mean estimated polyunsaturated fat intake among residents who reported "choosing to eat foods or types of foods because of the unsaturated fat content" was significantly ($p < 0.05$) lower among females between 35-49 years and significantly ($p < 0.05$) higher among females between 65-74 years (Table 4.13). The mean estimated monounsaturated fat intake among residents who reported "choosing to eat foods or types of foods because of the unsaturated fat content" was significantly ($p < 0.05$) lower among males between 35-

49 years and 50-64 years and among females between 18-34 years and 35-49 years (Table 4.13 appears at end of chapter 4).

4. Dietary Cholesterol

The proportion of Alberta residents who reported "avoiding foods or types of foods because of the cholesterol content" ranged from 20% of males between 18-34 years to approximately 56% of females between 50-64 years (Table 4.14). Males between 18-34 years and 50-64 years and females between 65-74 years who reported "avoiding foods or types of foods because of the cholesterol content" consumed significantly ($p < 0.05$) less cholesterol on average compared to residents who did not report "avoiding foods or types of foods because of the cholesterol content". It was found that males between 18-34 years who reported "avoiding foods or types of foods because of the cholesterol content" consumed approximately 123 mg (or 28%) less cholesterol on average than males who did not report "avoiding foods or types of foods because of the cholesterol content" (Table 4.14 appears at end of chapter 4).

C. Estimated Percent Energy From Dietary Fat

1. Effect of Age and Sex on Percent Energy From Total Fat

The mean estimated percent energy from total fat among Alberta residents was approximately 29.9% (data not shown). Females between 18-34 years and 65-74 years consumed significantly ($p < 0.05$) less mean dietary fat as a percentage of total energy compared to males between 35-49 years, 65-74 years and females between 35-49 years (Table 4.15). Males between 35-49 years and 65-74 years and females between 35-49 years consumed mean dietary fat intakes as a percentage of total energy that exceeded 30% (Table 4.15). Among Alberta residents who expressed a concern about cancer, the estimated mean percent energy from dietary fat was lower compared to the general Alberta population, particularly among males and females between 50-64 years and 65-74 years (Table 4.15 appears at end of chapter 4).

2. Effect of Smoking on Percent Energy From Total Fat

Both males and females that reported smoking obtained on average significantly ($p = 0.0029$) ($p = 0.0001$) more energy from dietary fat than non-smokers (Table 4.16 & 4.17). Results were similar among females who expressed a concern about cancer (Table 4.17).

Smokers consumed average percent energy intakes from dietary fat that exceeded 30%, regardless of sex (Table 4.16 & 4.17 appear at end of chapter 4).

3. Other Factors and their Relationship to Percent Energy From Total Fat

There was no significant ($p > 0.05$) effect of reported income level, educational attainment or employment status on the mean estimated percent energy from dietary fat among males and females in the Alberta population (Appendix A Tables 7-12).

D. Estimated Percent Energy From Saturated Fat

1. Effect of Age and Sex on Percent Energy From Saturated Fat

The mean estimated percent energy from saturated fat was approximately 11.6% among Alberta residents (data not shown). Males between 65-74 years and females between 35-49 years consumed significantly ($p < 0.05$) more energy as saturated fat compared to females between 65-74 years (Table 4.18). The mean estimated intake of saturated fat as a percentage of total energy exceeded the recommended intake of 10% for all age sex groups with the exception of females between 50-74 years of age who expressed a concern about cancer (Table 4.18 appears at end of chapter 4).

2. Effect of Income on Percent Energy From Saturated Fat

Females who reported household incomes of $60,000 or greater consumed significantly ($p < 0.05$) more percent energy from saturated fat on average compared to females who reported income levels of less than $10,000-19,999 and females who did not know or refused (Table 4.19). There was no significant ($p > 0.05$) effect of reported income level on the mean percent energy from saturated fat among males in the Alberta population (Appendix A Table). With the exception of females that reported income levels of less than $10,000-19, 999 females exceeded the recommendation to consume less than 10% energy from saturated fat (Table 4.19 appears at end of chapter 4).

3. Effect of Smoking on Percent Energy From Saturated Fat

Male smokers consumed significantly ($p = 0.0002$) more saturated fat on average as a percentage of total energy compared to non-smokers (Table 4.20). Female smokers consumed significantly ($p = 0.0001$) more percent energy from saturated fat on average than non-smokers (Table 4.21). Similar results were reported among females who expressed a concern about cancer. Non-smokers and smokers exceeded the recommendation to consume 10% or less energy from saturated fat (Table 4.20 & 4.21 appear at end of chapter 4).

4. Other Factors and their Relationship to Percent Energy From Saturated Fat

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment or employment status on the mean estimated percent energy from saturated fat among males and or females in the Alberta population (Appendix A Tables 13-19).

E. Estimated Percent Energy From Monounsaturated Fat

1. Effect of Age and Sex on Percent Energy From Monounsaturated Fat

The mean estimated percent energy from monounsaturated fat was approximately 12.8% among Alberta residents (data not shown). Males between 65-74 years consumed significantly ($p < 0.05$) less mean percent energy from monounsaturated fat compared to males between 18-34 years (Table 4.22). The average percent of energy from monounsaturated fat in the diet of females between 18-34 years was significantly ($p < 0.05$) higher than males of all ages and females between 35-49 years (Table 4.22). The estimated mean percent energy from monounsaturated fat ranged from 11.6% among males between 65-74 years to approximately 13.7% among females between 18-34 years. Among Alberta residents who expressed a concern about cancer, the mean estimated intake of monounsaturated fat as a percentage of total energy was lower compared to the general Alberta population with the exception of males between 65-74 years and females between 35-49 years (Table 4.22 appears at end of chapter 4).

2. Effect of Smoking on Percent Energy From Monounsaturated Fat

Both male and female smokers consumed significantly ($p = 0.0019$) ($p = 0.0002$) more percent energy from monounsaturated fat on average than non-smokers (Table 4.23 & 4.24). Results were similar among females who expressed a concern about cancer (Table 4.23 & 4.24 appears at end of chapter 4).

3. Other Factors and their Relationship to Percent Energy From Monounsaturated Fat

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment or employment status on the average percent energy from monounsaturated fat among males and or females in the Alberta population (Appendix A Table 20-26).

F. Estimated Percent Energy From Polyunsaturated Fat

1. Effect of Age and Sex on Percent Energy From Polyunsaturated Fat

The mean estimated percent energy from polyunsaturated fat was approximately 5.4% among Alberta residents (data not shown). Males between 65-74 years and females between 35-49 years consumed significantly ($p < 0.05$) more percent energy from polyunsaturated fat on average than males and females between 18-34 years and males between 50-64 years (Table 4.25 appears at end of chapter 4).

2. Other Factors and their Relationship to Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the mean estimated percent energy from polyunsaturated fat among males and or females in the Alberta population (Appendix A Tables 27-35).

G. Estimated P/S Fat Ratio

1. Effect of Age and Sex on P/S Fat Ratio

The average estimated P/S ratio among the Alberta population was approximately 0.54 (data not shown). The estimated P/S ratio ranged from approximately 0.50 to 0.63. Males between 18-34 years consumed a significantly ($p < 0.05$) lower estimated P/S ratio on average than females between 35-49 years and 50-64 years (Table 4.26). With the exception of females between 65-74 years of age, all Alberta residents who expressed a concern about cancer consumed higher estimated P/S ratios compared to the general Alberta population (Table 4.26). The mean estimated P/S ratio among the Alberta population was below the recommended level of one (Table 4.26 appears at end of chapter 4).

2. Effect of Income on P/S Fat Ratio

Females who did not know or refused to report their household income level consumed significantly ($p < 0.05$) higher mean estimated P/S ratios compared to females who reported income levels between $50,000-$59,999 (Table 4.27). There was no significant ($p > 0.05$) effect of reported income level on the mean estimated P/S ratio among males in the Alberta population (Appendix A Table). Females who expressed a concern about cancer consumed a higher estimated P/S ratio on average compared to the general female population (Table 4.27). The mean estimated P/S ratio was below the recommended level of one however, approached 1 among females who expressed a concern about cancer and who did not know or refused to report their household income level (Table 4.27 appears at end of chapter 4).

3. Effect of Smoking on P/S Fat Ratio

Both male and female smokers consumed significantly ($p = 0.0015$) ($p = 0.001$) lower estimated P/S ratios on average than non-smokers (Table 4.28 & 4.29). Results were similar among females who expressed a concern about cancer. The mean estimated P/S ratio was below the recommended level of one (Table 4.28 & 4.29 appear at end of chapter 4).

4. Other Factors and their Relationship to P/S Fat Ratio

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment or employment status on the mean estimated P/S ratio among males and or females in the Alberta population (Appendix A Tables 36-42).

H. Estimated Linoleic Acid Intake (grams/day)

1. Effect of Age and Sex on Linoleic Acid Intake

The estimated mean linoleic acid intake ranged from approximately 6.7 to 12.4 grams per day (Table 4.30). Females between 18-74 years of age had a significantly ($p < 0.05$) lower average daily intake of linoleic acid than males between 18-49 years and 65-74 years. Males between 50-64 years and females between 35-49 years consumed similar amounts of linoleic acid per day (Table 4.30). Alberta residents who expressed a concern about cancer consumed higher mean estimated intakes of linoleic acid per day compared to the general Alberta population, with the exception of males and females between 65-74 years (Table 4.30 appears at end of chapter 4). Approximately 48% of Alberta residents obtained less than 3% total energy from linoleic acid (data not shown). Significantly ($p < 0.001$) fewer males (44%) than females (52%) consumed less than 3% energy from linoleic acid (data not shown).

2. Other Factors and their Relationship to Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the mean estimated intake of linoleic acid among males and or females in the Alberta population (Appendix A Tables 43-51). However, significantly ($p < 0.05$) fewer non-smokers consumed less than 3% energy from linoleic acid than smokers (data not shown). Significantly ($p < 0.05$) more males that reported smoking (51%) consumed less than 3% energy from linoleic acid than non-smokers (42%) (data not shown). There was no significant ($p > 0.05$) effect of smoking on the proportion of females that consumed less than 3% energy from linoleic acid (data not shown).

I. Estimated Linolenic Acid Intake (grams/day)

1. Effect of Age and Sex on Linolenic Acid Intake

Males between 18-34 years consumed significantly ($p < 0.05$) higher estimated intakes of linolenic acid per day on average than males between 65-74 years (Table 4.31). Females between 35-49 years consumed significantly ($p < 0.05$) higher mean intakes of linolenic acid per day than females between 50-64 years and 65-74 years (Table 4.31 appears at end of chapter 4). Significantly ($p < 0.001$) more females (44%) than males (40%) consumed less than 0.5% energy from linolenic acid (data not shown).

2. Effect of Employment on Linolenic Acid Intake

Males who reported unemployment (homemaker or student) status consumed significantly ($p = 0.0089$) higher estimated intakes of linolenic acid per day on average than males who reported part-time employment (self-employment or retirement) status (Table 4.32). There was no significant ($p > 0.05$) effect of employment status on the mean estimated intake of linolenic acid among females in the Alberta population (Appendix A Table) (Table 4.32 appears at end of chapter 4). There was no significant ($p > 0.05$) effect of employment status on the proportion of residents that consumed less than 0.5% energy from linolenic acid (data not shown).

3. Other Factors and their Relationship to Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the average estimated intake of linolenic acid among males and or females in the Alberta population (Appendix A Tables 52-60).

J. Estimated Omega 6:Omega 3 Ratio

1. Effect of Age and Sex on Omega 6:Omega 3 Ratio

The estimated mean omega 6:omega 3 ratio ranged from 6.6 among males between 50-64 years to approximately 10.5 among females between 50-64 years (Table 4.33). Females between 50-64 years consumed significantly ($p < 0.05$) higher mean estimated omega 6:omega 3 ratios compared to males between 50-64 years (Table 4.33). Among Alberta residents who expressed a concern about cancer, the mean estimated omega6:omega 3 ratio was higher compared to the general Alberta population, with the exception of females between 65-74 years of age (Table 4.33). Females between 50-64 years of age who expressed a concern about cancer, exceeded the suggestion to consume an omega 6:omega 3 ratio between 4:1 to 10:1 (Table 4.33 appears at end of chapter 4). (Neuringer and Connor, 1986).

2. Other Factors and their Relationship to Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the mean omega 6:omega 3 ratio among males and or females in the Alberta population (Appendix A Tables 61-70).

K. Estimated Cholesterol Intake (milligrams/day)

1. Effect of Age and Sex on Cholesterol Intake

The total mean estimated dietary cholesterol intake among the Alberta population was approximately 294 mg per day (data not shown). The average cholesterol intake ranged from 196 mg per day among females between 65-74 years to approximately 433 mg per day among males between 18-34 years (Table 4.34). Males between 18-74 years consumed significantly ($p < 0.05$) higher intakes of cholesterol on average compared to females of the same age (Table 4.34). Males of all ages consumed average dietary cholesterol intakes that exceeded 300 mg per day (Table 4.34).

Table 4.34 Total Cholesterol Intake by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)
Males 18-34	275	433^{a}	406	17	1822
Males 35-49	262	$360^{a,b}$	351	2	2071
Males 50-64	258	315^{b}	202	0	1453
Males 65-74	180	331^{b}	174	21	1375
Females 18-34	312	$231^{c,d}$	205	0	924
Females 35-49	290	251^{c}	179	0	882
Females 50-64	286	$227^{c,d}$	151	2	2011
Females 65-74	176	196^{d}	101	13	817

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Males between 65-74 years consumed significantly ($p < 0.05$) higher intakes of cholesterol per 1000 kilo-calories on average than males between 18-64 years and females between 18-74 years inclusive (Table 4.35).

Table 4.35 Total Cholesterol Intake per 1000 Kcal by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (mg/1000 kcal)	Standard Deviation	Minimum (mg/1000 kcal)	Maximum (mg/1000 kcal)
Males 18-34	275	$137^{a,b,c}$	118	10	574
Males 35-49	262	$137^{b,c}$	107	2	615
Males 50-64	258	140^{c}	91	0	1195
Males 65-74	180	172^{d}	96	27	706
Females 18-34	312	120^{a}	99	0	585
Females 35-49	290	$141^{b,c}$	97	0	622
Females 50-64	286	$139^{b,c}$	82	2	1239
Females 65-74	176	$130^{a,b}$	68	13	521

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

L. Estimated Dietary Fibre Intake

1. Effect of Age and Sex on Dietary Fibre Intake

The total mean estimated dietary fibre intake among Alberta residents 18-74 years was approximately 15.5 ± 9.8 g per day (data not shown). Approximately fifty percent of the Alberta population consumed less than 13.7 grams of dietary fibre per day (data not shown). Twenty five percent of the Alberta population consumed less than 9.0 grams of dietary fibre per day. Males between 18-74 years had a significantly ($p < 0.05$) higher intake of dietary fibre per day on average than females of the same age (Table 4.36). There were no significant ($p > 0.05$) effects of age on the mean dietary fibre intakes among females (Table 4.36). Among Alberta residents who expressed a concern about cancer, males between 18-34 years consumed significantly ($p < 0.05$) higher mean estimated intakes of dietary fibre per day than any other age sex grouping. The mean dietary fibre intake was higher for all age sex groups who expressed a concern about cancer compared to the general Alberta population (Table 4.36). Approximately seventy five percent of Alberta residents consumed less than 19.6 grams of dietary fibre per day (data not shown). Residents more likely to meet the recommendation to consume between 20-30 grams of dietary fibre per day include males between 18-34 years, and males 18-49 years who expressed a concern about cancer (Table 4.36 appears at end of chapter 4).

2. Effect of Income on Dietary Fibre Intake

Males that reported household income levels of less than $10,000-$39,999 consumed significantly ($p < 0.05$) less dietary fibre per day compared to males who reported income levels between $40,000-$49,999 (Table 4.37). There was no significant effect of reported income level on the mean dietary fibre intakes among females in the Alberta population (Appendix A Table). Among residents who expressed a concern about cancer, males who reported income levels between $40,000-$49,999 had a significantly ($p < 0.05$) higher mean estimated dietary fibre intake per day than males who reported income levels between $20,000-$29,999 (Table 4.37). A greater proportion of males had daily estimated fibre intakes below the recommended levels of 20-30 grams per day, regardless of reported income level. However, among males who expressed a concern about cancer, their estimated mean dietary fibre intake was above the minimum recommended level. The exception being, males who reported income levels between $20,000-29,999 and those who did not know or refused to report their household income level (Table 4.37 appears at end of chapter 4).

3. Effect of Smoking on Dietary Fibre Intake

The mean daily estimated fiber intake for male smokers was significantly ($p = 0.0001$) less than that for non-smokers (Table 4.38). Similarly, female smokers consumed significantly ($p = 0.0001$) less mean dietary fibre per day than non-smokers (Table 4.39). The same relationship between smoking and fiber intake was seen in the subset of the population that expressed a concern about cancer. The mean intake of all groups, except non-smoking males was below recommended levels of 20-30 grams per day (Table 4.38 & 4.39 appears at end of chapter 4).

4. Other Factors and their Relationship to Dietary Fibre Intake

There was no significant ($p > 0.05$) effect of marital status, household income level, educational attainment or employment status on the mean dietary fibre intake among males and or females in the Alberta population (Appendix A Tables 71-79).

M. Estimated Dietary Fibre Density (grams/1000 kilo-calories)

1. Effect of Age and Sex on Dietary Fibre Density

Males between 50-74 years consumed significantly ($p < 0.05$) more mean dietary fibre per 1000 kilo-calories than males between 18-49 years (Table 4.40). The same age relationship with fibre intake was observed for females. The fibre density of diets consumed by females increased significantly ($p < 0.05$) with increasing age (Table 4.40). Females consumed significantly ($p < 0.05$) more mean dietary fibre per 1000 kilo-calories than males of the same age, except individuals aged 18-34 years.

Table 4.40 Dietary Fibre Intake per 1000 Kcal by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g/1000 kcal)	Standard Deviation	Minimum (g/1000 kcal)	Maximum (g/1000 kcal)
Males 18-34	275	6.5^{a}	3.5	0.6	19.8
Males 35-49	262	7.0^{a}	4.1	0.6	20.5
Males 50-64	258	7.9^{b}	3.2	0.0	22.8
Males 65-74	180	$8.1^{b,c}$	3.6	0.5	37.7
Females 18-34	312	7.3^{a}	4.3	0.0	22.0
Females 35-49	290	8.0^{b}	4.2	1.2	26.4
Females 50-64	286	$8.7^{c,d}$	3.3	2.0	32.3
Females 65-74	176	9.9^{d}	3.1	2.3	24.1

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

2. Effect of Income on Dietary Fibre Density

Males who reported household income levels between $40,000-$49,999 consumed significantly ($p < 0.05$) more mean dietary fibre per 1000 kilo-calories than males who reported income levels of $39,999 or less (Table 4.41). With the exception of individuals who reported income levels between $40,000-49,999, females consumed more dietary fibre per 1000 kilo-calories than males (Table 4.42).

Table 4.41 Dietary Fibre Intake per 1000 Kcal by Income—Males (weighed sample)

Income Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
<$10,000-$19,999	146	6.6^{a}	2.8	0.7	20.5
$20,000-$29,999	107	6.9^{a}	3.2	0.0	18.9
$30,000-$39,999	138	6.5^{a}	2.9	1.0	16.1
$40,000-$49,999	94	7.6^{b}	5.2	1.3	37.7
$50,000-$59,999	96	7.4^{a}	3.6	0.6	19.4
$60,000 +	304	$7.3^{a,b}$	3.7	1.3	22.8
Do not know & refused	87	$6.4^{a,b}$	3.8	0.9	32.6

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.42 Dietary Fibre Intake per 1000 Kcal by Income—Females (weighed sample)

Income Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
<$10,000-$19,999	192	$8.1^{a,b}$	3.3	0	27.7
$20,000-$29,999	127	7.5^{a}	3.3	2.2	21.5
$30,000-$39,999	135	$8.7^{a,b}$	4.8	1.6	26.4
$40,000-$49,999	117	$7.6^{a,b}$	4.1	2.3	22.0
$50,000-$59,999	102	$8.4^{a,b}$	4.0	2.0	24.3
$60,000 +	231	$7.7^{a,b}$	3.7	1.2	23.8
Do not know & refused	158	8.5^{b}	4.2	2.0	32.3

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

N. Estimated Percent Energy From Carbohydrate

1. Effect of Age and Sex on Percent Energy From Carbohydrate

The mean estimated percent energy from carbohydrates among males and females between 18-74 years was approximately 50% (data not shown). Males between 18-34 years consumed approximately 50% of their energy from carbohydrates on average (Table 4.43). However, the mean energy contribution of carbohydrates in the diet of males between 35-74 years was less than 50% (Table 4.43). With the exception of females between 35-49 years, the mean energy contribution of carbohydrates for females was higher than 50% (Table 4.43). On average, carbohydrates provided a greater proportion of energy in the diet ($p < 0.05$) of females than males of the same age (Table 4.43). Significantly ($p < 0.001$) more males than females consumed 55% or less energy from carbohydrates (Table 4.43). The proportion of Alberta residents that consumed 55% or less energy from carbohydrates ranged from 55% of females between 18-34 years to approximately 77% of males aged 35-49 years (Table 4.43 appears at end of chapter 4).

O. Estimated Dietary Fat and Fibre Consumption

1. Effect of Age and Sex on Dietary Fat and Fibre Intake

Approximately 39% of Alberta residents consumed a diet high in fat (greater than 30% of total energy intake) and low in fibre (less than 20 grams/day) compared to 14% of residents who consumed the recommended diet composition, one that is low in fat and high in fibre (data not shown). With the exception of males and females between 65-74 years, females were more likely than males to consume a diet high in fat and low in fibre (Figure 4.1). Males were also more likely than females to consume a diet high in fat and high in fibre (Figure 4.2). Females were more likely than males of all ages to consume diets low in fat and low in fibre, particularly females between 18-34 years (Figure 4.1). Approximately 1 in 5 males between 18-34 years consumed diets low in fat and high in fibre compared to only 1 in 11 females of the same age meeting this recommendation. Alberta residents were significantly ($p < 0.001$) more likely to consume diets either high in fat and low in fibre or low in fat and low in fibre (data not shown). Females between 18-34 (3%) and 50-64 years (5%) were least likely to consume diets high in fat and high in fibre (Figures 4.1 & 4.2 appear at end of chapter 4).

III. DIETARY FAT SUMMARY

Estimated Dietary Fat Intake

Males and females between 18-49 years consumed significantly ($p < 0.05$) higher intakes of fat on average than males and females between 50-74 years. Females between 65-74 years consumed significantly ($p < 0.05$) lower intakes of fat on average, particularly saturated fat, as a percentage of total energy than males between 65-74 years. Males between 18-74 years consumed significantly ($p < 0.05$) higher intakes of cholesterol on average than females of the same age. The socio-economic factors associated with fat intake included reported income level (see chapter 3 Bonferroni method), employment status and smoking. Females who reported household income levels of $60,000 or greater consumed significantly ($p < 0.05$) higher intakes of saturated fat on average, as a percentage of total energy (12.2%), than females who reported income levels of less than $10,000-19,999 (10.4%). Males who reported unemployment (homemaker or student) status consumed significantly ($p < 0.05$) higher intakes of fat on average than males who reported full-time employment or part-time employment (self-employment or retirement) status. Male and female smokers consumed significantly ($p < 0.05$) higher intakes of fat, and a greater proportion of energy from fat, saturated fat and monounsaturated fat on average than non-smokers. Male and female smokers consumed a significantly ($p < 0.05$) lower P/S ratio on average than non-smokers.

Although most Alberta residents reported avoiding foods or types of foods because of the fat content or types of fat, some age groups were more successful at reducing their intake of fat than others. Males and females between 18-34 years and females between 35-49 years who reported avoiding foods or types of foods because of the fat content consumed significantly ($p < 0.05$) lower intakes of fat on average than males and females who did not report avoiding foods because of the fat content. Males and females between 35-49 years, who reported avoiding foods or types of foods because of the saturated fat content consumed significantly ($p < 0.05$) less saturated fat on average. Females between 67-74 years who reported choosing to eat foods or types of foods because of the unsaturated fat content consumed significantly ($p < 0.05$) higher intakes of polyunsaturated fat on average. Males between 18-34 years, and females between 65-74 years who reported avoiding foods or types of foods because of the cholesterol content consumed significantly ($p < 0.05$) lower intakes of cholesterol on average.

IV. DIETARY FIBRE SUMMARY

Estimated Dietary Fibre Intake

Overall, Alberta residents consumed dietary fibre intakes below recommended levels of 20-30 grams per day. Many Alberta residents consumed carbohydrates at levels that are more consistent with the lower range of carbohydrate intake (50-60%) recommended by Health and Welfare Canada (1990). There were main findings of estimated dietary fibre intakes below the recommended levels among males and females by age and sex and smoking status and among males by reported income level. The mean intake of fibre for males between 18-74 years was higher ($p < 0.05$) than that of females of the same age. However, males and females between 50-74 years consumed significantly ($p < 0.05$) more fibre dense diets than males and females between 18-49 years; respectively. Smokers had a significantly ($p < 0.05$) lower estimated intake of dietary fibre on average than non-smokers, regardless of sex. Males that reported household income levels between \$40,000-49,999 consumed a dietary fibre intake and more fibre dense diet that was significantly ($p < 0.05$) higher than males who reported household income levels of \$39,999 or less. Overall, there were main findings of risk for a diet marked by high dietary fat and low dietary fibre intakes among males and females by age and sex. Males and females between 18-34 years and females between 65-74 years were more likely to consume a diet low in fat (30% or less energy from dietary fat) and low in fibre (less than 20 grams per day). Males and females between 35-49 years and 50-64 years and males between 65-74 years were more likely to consume a diet high in fat (greater than 30% energy from dietary fat) and low in fibre (less than 20 grams per day).

V. DISCUSSION

Approximately half of the Alberta population (in each age sex grouping) did not meet the recommendation to consume 30% or less energy from fat and approximately 75% of residents consumed less than 20 grams of dietary fibre per day. These findings are consistent with nutrition surveys done in Nova Scotia, Montreal (Quebec), Manitoba and Saskatchewan (unpublished data). However, Alberta residents are now closer to meeting the recommendation regarding dietary fat than they were in the Nutrition Canada Survey (1973). In the Nutrition Canada Survey (1973), fat provided approximately 40% of the total energy intake on average (Nutrition Canada Survey, 1973) and the average daily fibre intake was 14.6 grams (6.3 g/1000 kcal). In the Alberta Nutrition Survey (1994), the average percent energy intake from fat was approximately 30% and the amount of dietary fibre consumed was approximately 15.5 grams per day. In the Nutrition Canada Survey (1972) and the Alberta Nutrition Survey (1994) different methodologies were used to estimate dietary fibre intakes and therefore does not permit direct comparisons. However, the current survey suggests that fibre intake has not increased significantly among Alberta residents during the past 30 years and that residents have not replaced fat in the diet with complex carbohydrates (i.e. those that provide dietary fibre).

Alberta residents continue to obtain more than 10% of their total energy intake as saturated fat and disproportionately less energy from polyunsaturated fat, resulting in average P/S ratios below 1. The current recommendation to consume a P/S ratio of 1 is controversial, as some researchers believe this recommendation is too high, particularly in reducing the age specific incidence rate of cancer. In any case, the intake of foods containing essential fatty acids, particularly omega 3 fatty acids, is lower than what is recommended. Population estimates for omega 6:omega 3 ratios are between 4:1 to 10:1. The Alberta Nutrition Survey results suggest that on average Alberta residents are consuming omega 6:omega 3 ratios between 6.6:1 to 10.5 to 1.

Linoleic acid is the predominant polyunsaturated fatty acid obtained in the diet. Limited epidemiologic data suggest that diets high in linoleic acid (more than 7% of total energy) are associated with an increased risk of developing cancer, particularly breast cancer, by predisposing membrane phospholipids to free radical oxidation (Grundy, 1997). Conversely, linolenic acid, an omega 3 polyunsaturated fatty acid may suppress tumor growth by enhancing programmed cell death (apoptosis) (Williams, 1991). In the present study we were unable to separate out linolenic acid from the longer chain omega 3 fatty acids, but the low intake of omega 3 fatty acids suggests that the consumption of fish and shellfish in the diets of Alberta residents is low. Most of the epidemiological work suggesting a benefit of omega 3 fatty acids has been found with the longer chain polyunsaturated omega 3 fatty acids found in fish oils.

Although specific types of dietary fibre intake were not assessed in the Alberta Nutrition Survey (1994) evidence suggests that Alberta residents may be choosing more foods containing simple carbohydrates rather than more complex carbohydrates. This conclusion is implied from the low intake of dietary fibre in the population, particularly for females. Males consumed between 15.8-20.2 grams of dietary fibre per day on average compared to females who consumed between 13.3-14.7 grams of fibre per day on average. The higher total food intake by males likely accounts for this difference in total intake however, females were found to consume significantly ($p < 0.05$) more fibre dense diets than males.

In 1985, the National Cancer Institute recommended that 20-30 grams of dietary fibre be consumed daily to reduce the risk of cancer. The Nutrition Recommendations (1990) put forth by the Scientific Review Committee state that "the Canadian diet should provide 55% of energy as carbohydrates (138 g/1000kcal or 165 g/5000 kJ) from a variety of food sources". However, no specific recommendations regarding dietary fibre intake were indicated. The Scientific Review Committee assumed that if carbohydrates were consumed at the level suggested (50-60% of energy), then adequate dietary fibre would be consumed (Nova Scotia Nutrition Survey, 1990). Evidence obtained from the Alberta Nutrition Survey (1994) suggest that this assumption may be too general and that education programs promoting more specific recommendations on how to select fibre dense foods may be warranted.

Food selections are based on a variety of factors including nutritional knowledge, food preferences, availability, budget restrictions, cultural environment, convenience and more fundamental psychological and physiological influences (Yudkin, 1956; Krondl and Lau, 1982; Booth and Shepherd, 1988; Subar, 1994). Consuming a diet low in fat and high in dietary fibre can be achieved in a variety of ways, such as increasing consumption of vegetables and fruit, complex carbohydrates, and or low fat dairy products, and decreasing consumption of meats, added fats, whole milk and cheese products. In the Alberta Nutrition Survey (1994) approximately 19% of males and 10% of females between 18-74 years consumed a diet low in fat (30% or less of total energy intake) and high in fibre (greater than 20 grams per day). Alberta residents were more likely to consume a diet high in fat (greater than 30% of total energy intake) and low in fibre (less than 20 grams per day) or low in fat (30% or less total energy intake) and low in fibre (less than 20 grams per day) (39% and 37%, respectively).

In Australia (Baghurst et al., 1990; Smith and Baghurst, 1992) and the United States (Kushi et al., 1988) higher dietary fat intakes and lower dietary fibre intakes have been associated with lower socioeconomic status. In the Alberta Nutrition Survey (1994), females who reported higher household income levels ($60,000 or greater) consumed significantly ($p < 0.05$) more energy from saturated fat on average than females who reported lower incomes (less than $19,999). Evidence suggests that people who eat at fast food restaurants approximately 3-4 times per week, consume a greater proportion of energy from fat (Nolan et al., 1995) and in the Alberta Nutrition Survey, females in the higher income cohort reported eating out in fast food restaurants more frequently than those in the lower income cohort (36% vs 23% reported eating at fast food restaurants 1-

2 times per week). As no effect of household income level was reported among females regarding total fat intake, these results should be interpreted with caution.

In the Alberta Nutrition Survey, males who reported household income levels between $40,000-49,999 consumed significantly ($p < 0.05$) higher intakes of dietary fibre on average than males who reported household income levels of $39,999 or less (19.1 vs 16.0 grams, respectively). In the National Population Health Survey (1996) Canadians who were in the lowest income category were more likely than Canadians in the highest income category to express the belief that Grain Products "are too expensive" and "do not taste good" and our results might support the translation of these beliefs into dietary practice.

Males who reported unemployment consumed significantly ($p < 0.05$) higher intakes of fat and linolenic acid (grams per day) than males who reported employment. The more frequent consumption of meals at fast food restaurants by males that are unemployed may have contributed to this higher intake of fat. Foods in fast food restaurants have been found to be high in fat (Jeffrey and French, 1998). Research suggests that individuals who frequently eat foods prepared by the fast food service industry consume significantly less fruit and vegetables and milk products and are therefore less likely to meet dietary recommendations (Hughes et al., 1997). The researchers stated that public health nutrition programs will have limited effect unless the food service industry is supportive of dietary changes that are more consistent with dietary recommendations (Hughes et al., 1997).

Males and females who reported smoking consumed significantly ($p < 0.05$) more energy from fat, particularly saturated and monounsaturated fat and significantly ($p < 0.05$) lower P/S ratios and less dietary fibre on average than non-smokers. This is consistent with the finding that male and female smokers consume higher intakes of fat and lower intakes of fibre than non-smokers (Tousey et al., 1999; English et al., 1997). Smoking has also been negatively associated with attitudes about healthy eating (Smith et al., 1997) regarding fat and dietary fibre intakes.

In the Alberta Nutrition Survey, more females than males (in each age sex grouping), reported avoiding foods or types of foods because of the fat content, saturated fat content and cholesterol content and choosing foods or types of foods because of the unsaturated fat content. Several reports indicate a relationship between nutritional knowledge and attitudes (Shwartz, 1975; Grotowski and Sims, 1978; Axelson et al., 1983; Shepherd and Stockley, 1985; Shepherd, 1988; Saunders and Rahilly, 1990) towards food selection. It appears that many Alberta residents may be aware of the relationship between total fat intake and risk of chronic disease and are choosing or avoiding foods or types of foods accordingly, particularly females. Yet, results from the Alberta Nutrition Survey (1994) regarding dietary fibre intake suggest that greater emphasis should be placed on the importance of fibre and sources of dietary fibre as it relates to risk of chronic disease and improved health.

Overall, results from the Alberta Nutrition Survey suggest that only 19% of males and 10% of females are consuming a diet low in fat and high in fibre. Diets low in fat and high in fibre have been associated with a lower risk of developing some forms of cancer. Eating at fast food restaurants was associated with higher intakes of fat, particularly saturated fat, but not dietary fibre and was associated with females with higher incomes and unemployed males. Males and females who reported smoking were more likely to consume a diet high in fat and low in fibre and these dietary practices may make them more 'susceptible' to developing some forms of cancer. Results from the Alberta Nutrition Survey suggest that educational campaigns that promote alternate food choices that are lower in fat, particularly saturated fat, and higher in omega 3 fatty acids, and complex carbohydrates or fibre may be warranted. In addition, opportunities exist for fast food restaurants to provide and promote choices that are more consistent with the recommendations to consume a diet low in fat and high in fibre.

Table 4.7 Total Fat Intake by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Males 18-34	275	105^{a}	75	10	541	25	117^{a}
Males 35-49	262	90^{b}	58	4	307	50	100^{b}
Males 50-64	258	77^{c}	36	3	284	47	$74^{b,c}$
Males 65-74	180	72^{c}	23	5	171	30	$62^{c,d}$
Females 18-34	312	61^{d}	42	3	198	55	$59^{c,d,e}$
Females 35-49	290	67^{d}	39	7	241	97	$67^{c,d,e}$
Females 50-64	286	53^{e}	21	8	163	78	$48^{d,e}$
Females 65-74	176	50^{e}	19	6	177	51	44^{e}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.8 Total Fat Intake by Employment—Males (weighed sample)

Employment Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Full-time	472	91^{a}	53	4	290	76	105^{a}
Part-time, Self-employed & Retired	413	86^{b}	39	3	255	68	68^{a}
Unemployed, Homemaker & Student	87	117^{c}	103	10	541	7	155^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.9 Total Fat Intake by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	743	91^{a}	55	3	541	126	93^{a}
Smokers	229	97^{b}	56	9	307	25	116^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.10 Total Fat Intake by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	807	59^a	32	5	216	233	58^a
Smokers	256	65^b	37	3	241	47	57^a

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Are you avoiding foods or types of foods because of the fat content?

Table 4.11 Response Rate &Total Mean Fat Intake (weighed sample mean)

Response & Total Mean Dietary Fat Intake	Total 18-74	Males 18-34	Males 35-49	Males 50-64	Males 65-74	Females 18-34	Females 35-49	Females 50-64	Females 65-74
Yes	1205 (59%)	106 (39%)	139 (53%)	147 (57%)	97 (54%)	188 (60%)	194 (67%)	209 (73%)	125 (71%)
Total Mean Dietary Fat Intake (g)	65 g	87 g	85 g	73 g	73 g	53 g	60 g	54 g	50 g
No	834 (41%)	169 (61%)	123 (47%)	111 (43%)	83 (46%)	124 (40%)	96 (33%)	77 (27%)	51 (29%)
Total Mean Dietary Fat Intake (g)	83 g	114 g	96 g	83 g	76 g	73 g	70 g	53 g	53 g
Total Mean Dietary Fat Intake (g) (total response)	72 g	103 g	90 g	77 g	74 g	61 g	63 g	54 g	51 g
Is there a difference in total mean dietary fat intake between those avoiding foods or types of foods because of the fat content?	$p < 0.05$	$p < 0.05$	NS	NS	NS	$p < 0.05$	$p < 0.05$	NS	NS

Proportions based on un-weighed data

Are you avoiding foods or types of foods because of the saturated fat content?

Table 4.12 Response Rate & Mean Saturated Fat Intake (weighed sample mean)

Response & Mean Saturated Fat Intake	Total 18-74	Males 18-34	Males 35-49	Males 50-64	Males 65-74	Females 18-34	Females 35-49	Females 50-64	Females 65-74
Yes	836 (41%)	52 (19%)	93 (35%)	108 (42%)	73 (41%)	104 (33%)	133 (46%)	172 (60%)	101 (57%)
Mean Saturated Fat Intake (g)		36 g	30 g	27 g	26 g	21 g	22 g	20 g	19 g
No	1203 (59%)	223 (81%)	169 (65%)	150 (58%)	107 (59%)	208 (67%)	157 (54%)	114 (40%)	75 (43%)
Mean Saturated Fat Intake (g)		41 g	38 g	32 g	29 g	26 g	26 g	21 g	21 g
Total Mean Saturated Fat Intake (g) (total response)		40 g	35 g	30 g	28 g	25 g	24 g	20 g	20 g
Is there a difference in mean SFA intake between those avoiding foods because of the saturated fat content?		NS	$p < 0.05$	$p < 0.05$	NS	$p < 0.05$	$p < 0.05$	NS	NS

Proportions based on un-weighed data

Are you choosing to eat foods or types of foods because of the unsaturated fat content?

Table 4.13 Response Rate & Mean Unsaturated Fat Intake (weighed sample mean)

Response & Mean Unsaturated Fat Intake	Total 18-74	Males 18-34	Males 35-49	Males 50-64	Males 65-74	Females 18-34	Females 35-49	Females 50-64	Females 65-74
Yes	822 (40%)	60 (22%)	86 (33%)	105 (41%)	74 (41%)	96 (31%)	138 (48%)	169 (59%)	94 (53%)
Mean Polyunsaturated Fat Intake (g)	12.2 g	17.1 g	15.7 g	13.3 g	14.0 g	10.0 g	10.3 g	10.8 g	10.6 g
Mean Monounsaturated Fat Intake (g)	26.8 g	39.7 g	33.0 g	31.0 g	30.4 g	21.0 g	23.9 g	22.9 g	22.4 g
No	1217 (60%)	215 (78%)	176 (67%)	153 (59%)	106 (59%)	216 (69%)	152 (52%)	117 (41%)	82 (47%)
Mean Polyunsaturated Fat Intake (g)	13.5 g	18.3 g	16.5 g	13.3 g	13.4 g	10.9 g	13.7 g	9.4 g	8.2 g
Mean Monounsaturated Fat Intake (g)	33.9 g	46.3 g	41.7 g	35.9 g	33.9 g	27.7 g	29.9 g	22.7 g	19.8 g
Is there a difference in mean PUFA intake between those choosing to eat foods because of the unsaturated fat content?	$p < 0.05$	NS	NS	NS	NS	NS	$p < 0.05$	NS	$p < 0.05$
Is there a difference in mean MUFA intake between those choosing to eat foods because of the unsaturated fat content?	$p < 0.05$	NS	$p < 0.05$	$p <0.05$	NS	$p < 0.05$	$p < 0.05$	NS	NS

Proportions based on un-weighed data

Are you avoiding foods or types of foods because of the cholesterol content?

Table 4.14 Response Rate & Mean Cholesterol Intake (weighed sample mean)

Response & Mean Dietary Cholesterol Intake	Total 18-74	Males 18-34	Males 35-49	Males 50-64	Males 65-74	Females 18-34	Females 35-49	Females 50-64	Females 65-74
Yes	787 (39%)	55 (20%)	91 (35%)	112 (43%)	61 (34%)	95 (30%)	121 (42%)	160 (56%)	92 (52%)
Mean Dietary Cholesterol Intake (mg)		313 mg	347 mg	287 mg	301 mg	211 mg	229 mg	222 mg	175 mg
No	1252 (61%)	220 (80%)	171 (65%)	146 (57%)	119 (66%)	217 (70%)	169 (58%)	126 (44%)	84 (48%)
Mean Dietary Cholesterol Intake (mg)		436 mg	382 mg	361 mg	371 mg	229 mg	257 mg	242 mg	221 mg
Mean Dietary Cholesterol Intake (mg) (total response)		411 mg	370 mg	329 mg	347 mg	223 mg	245 mg	231 mg	197 mg
Is there a difference in mean dietary cholesterol intake between those avoiding foods because of the cholesterol content?		$p < 0.05$	NS	$p < 0.05$	NS	NS	NS	NS	$p < 0.05$

Proportions based on un-weighed data

Table 4.15 Percent Energy From Total Fat by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Males 18-34	275	$29.2^{a,b}$	9.8	4.3	61.3	25	29.0^{a}
Males 35-49	262	$30.7^{b,c}$	10.4	3.7	55.9	50	29.9^{a}
Males 50-64	258	$30.2^{a,b,c}$	7.2	2.3	55.7	47	28.2^{a}
Males 65-74	180	31.8^{c}	6.2	10.6	56.0	30	29.2^{a}
Females 18-34	312	27.6^{a}	11.3	1.7	53.7	55	27.7^{a}
Females 35-49	290	$32.1^{b,c}$	10.0	7.3	60.0	97	32.0^{a}
Females 50-64	286	$29.1^{a,b}$	7.4	8.6	60.6	78	26.9^{a}
Females 65-74	176	28.5^{a}	6.2	4.3	50.9	51	25.8^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.16 Percent Energy From Total Fat by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	743	29.8^{a}	8.3	3.7	56.0	126	28.9^{a}
Smokers	229	31.3^{b}	10.0	2.3	61.3	25	31.2^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.17 Percent Energy From Total Fat by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	807	28.7^{a}	9.4	4.3	60.6	233	28.4^{a}
Smokers	256	31.4^{b}	9.4	1.7	56.2	47	32.9^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.18 Percent Energy From Saturated Fat by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Males 18-34	275	11.5^{a,b}	4.7	1.5	27.6	25	11.6^{a}
Males 35-49	262	11.8^{a,b}	4.9	2.1	26.0	50	11.4^{a}
Males 50-64	258	11.7^{a,b}	3.9	0.8	28.2	47	11.0^{a}
Males 65-74	180	12.0^{a}	3.1	1.9	25.0	30	11.0^{a}
Females 18-34	312	11.2^{a,b}	5.4	1.2	29.0	55	11.2^{a}
Females 35-49	290	12.0^{a}	4.6	1.8	34.6	97	11.7^{a}
Females 50-64	286	11.3^{a,b}	3.9	1.5	28.5	78	9.9^{a}
Females 65-74	176	11.0^{b}	2.9	1.9	26.0	51	9.9^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.19 Percent Energy From Saturated Fat by Income—Females (weighed sample)

Income Females	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
<$10,000-$19,999	192	10.4^{a}	3.4	1.2	34.6	40	9.8^{a}
$20,000-$29,999	127	12.0^{ab}	4.1	2.5	25.2	26	10.2^{a}
$30,000-$39,999	135	11.5^{ab}	4.6	1.3	26.3	41	11.2^{a}
$40,000-$49,999	117	11.8^{ab}	4.6	4.7	27.4	24	12.4^{a}
$50,000-$59,999	102	11.1^{ab}	4.5	3.3	23.1	36	9.9^{a}
$60,000 +	231	12.2^{b}	4.9	2.1	28.5	67	12.4^{a}
Do not know & refused	158	10.7^{a}	4.7	1.9	29.0	46	9.9^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.20 Percent Energy From Saturated Fat by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	743	11.5^{a}	4.1	0.8	28.2	126	11.2^{a}
Smokers	229	12.4^{b}	4.7	1.5	27.6	25	12.3^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.21 Percent Energy From Saturated Fat by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	807	11.0^{a}	4.4	1.3	29.0	233	10.7^{a}
Smokers	256	12.9^{b}	4.5	1.2	34.6	47	13.1^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.22 Percent Energy From Monounsaturated Fat by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Males 18-34	275	$12.6^{b,c}$	5.0	2.1	26.7	25	11.8^{a}
Males 35-49	262	$13.2^{c,d}$	5.1	0.6	27.4	50	12.8^{a}
Males 50-64	258	$13.1^{a,d}$	3.6	0.7	26.3	47	12.0^{a}
Males 65-74	180	11.6^{d}	5.4	0.5	27.0	30	12.7^{a}
Females 18-34	312	13.7^{a}	5.2	2.6	32.1	55	11.3^{a}
Females 35-49	290	$12.2^{c,d}$	3.3	3.8	27.3	97	13.1^{a}
Females 50-64	286	$12.2^{a,b,c}$	3.3	3.8	27.3	78	11.2^{a}
Females 65-74	176	$12.2^{a,b}$	3.1	1.3	22.4	51	11.0^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.23 Percent Energy From Monounsaturated Fat by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	743	12.8^{a}	4.2	0.6	30.6	126	12.0^{a}
Smokers	229	13.8^{b}	4.9	0.7	27.4	25	13.8^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.24 Percent Energy From Monounsaturated Fat by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Non-smokers	807	12.2^{a}	4.6	1.3	32.1	233	11.7^{a}
Smokers	256	13.3^{b}	4.4	0.5	25.4	47	13.5^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.25 Percent Energy From Polyunsaturated Fat by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (%)	Standard Deviation	Minimum (%)	Maximum (%)	Cancer Concerned Sample Size (N)	Mean (%)
Males 18-34	275	$5.1^{a,b}$	2.9	0.7	20.6	25	5.5^{a}
Males 35-49	262	$5.7^{a,b,c}$	3.4	1.0	18.3	50	5.7^{a}
Males 50-64	258	$5.2^{a,b}$	1.8	0.1	15.4	47	5.2^{a}
Males 65-74	180	5.9^{c}	2.1	1.3	18.5	30	5.6^{a}
Females 18-34	312	4.8^{a}	3.5	0	22.5	55	5.3^{a}
Females 35-49	290	6.3^{c}	4.6	1.1	39.6	97	7.2^{a}
Females 50-64	286	$5.6^{b,c}$	3.1	1.4	32.4	78	5.8^{a}
Females 65-74	176	$5.3^{a,b,c}$	1.8	1.1	20.9	51	4.8^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.26 Polyunsaturated—Saturated Fat Ratio by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Males 18-34	275	0.50^{a}	0.36	0.09	1.98	25	0.55^{a}
Males 35-49	262	$0.56^{a,b}$	0.44	0.05	2.22	50	0.62^{a}
Males 50-64	258	$0.54^{a,b,c}$	0.32	0.06	2.76	47	0.56^{a}
Males 65-74	180	$0.59^{a,b,c}$	0.32	0.11	2.59	30	0.68^{a}
Females 18-34	312	$0.52^{a,b}$	0.53	0.04	4.30	55	0.56^{a}
Females 35-49	290	$0.63^{b,c}$	0.65	0.08	5.80	97	0.76^{a}
Females 50-64	286	0.60^{c}	0.45	0.07	5.13	78	0.67^{a}
Females 65-74	176	$0.53^{a,b,c}$	0.22	0.08	1.82	51	0.52^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.27 Polyunsaturated—Saturated Fat Ratio by Income—Females (weighed sample)

Income Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
<$10,000-$19,999	192	$0.68^{a,b}$	0.55	0.04	4.30	40	$0.81^{a,b}$
$20,000-$29,999	127	$0.56^{a,b}$	0.42	0.08	2.70	26	0.68^{a}
$30,000-$39,999	135	$0.61^{a,b}$	0.40	0.12	2.36	41	$0.72^{a,b}$
$40,000-$49,999	117	$0.47^{a,b}$	0.28	0.12	2.10	24	0.48^{a}
$50,000-$59,999	102	0.48^{a}	0.34	0.10	2.0	36	0.52^{a}
$60,000 +	231	$0.51^{a,b}$	0.38	0.07	2.18	67	0.48^{a}
Do not know & refused	158	0.68^{b}	0.85	0.07	5.80	46	0.97^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.28 Polyunsaturated—Saturated Fat Ratio by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	743	0.56^{a}	0.39	0.09	2.76	126	0.62^{a}
Smokers	229	0.46^{b}	0.26	0.05	2.02	25	0.47^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.29 Polyunsaturated—Saturated Fat Ratio by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	807	0.60^{a}	0.54	0.07	5.80	233	0.67^{a}
Smokers	256	0.44^{b}	0.39	0.04	5.13	47	0.52^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.30 Total Linoleic Acid Intake by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Males 18-34	275	12.4^{a}	11	1	57	25	15.8^{a}
Males 35-49	262	$12.1^{a,b}$	13	0	79	50	$15.4^{a,b}$
Males 50-64	258	$9.5^{c,d}$	6	0	54	47	10.4^{b}
Males 65-74	180	$10.3^{b,c}$	6	1	59	30	$9.1^{b,c}$
Females 18-34	312	7.2^{e}	8	0	49	55	$7.7^{b,c}$
Females 35-49	290	$9.2^{d,e}$	9	1	54	97	$9.8^{b,c}$
Females 50-64	286	7.2^{e}	7	7	1	78	$8.1^{b,c}$
Females 65-74	176	6.7^{e}	4	0	57	51	5.6^{c}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.31 Total Linolenic Acid Intake by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Males 18-34	275	2.3^{a}	2.5	0.1	10.7	25	2.1^{a}
Males 35-49	262	$2.0^{a,b}$	1.8	0.5	8.7	50	2.0^{a}
Males 50-64	258	$1.8^{a,b}$	1.1	0.1	6.5	47	1.7^{a}
Males 65-74	180	$1.7^{b,c}$	0.9	0.2	5.9	30	1.5^{a}
Females 18-34	312	$1.3^{c,d}$	1.4	0	8.0	55	1.3^{a}
Females 35-49	290	$2.2^{b,c}$	7.1	0.1	75.0	97	3.4^{a}
Females 50-64	286	1.2^{d}	0.7	0.1	8.1	78	1.0^{a}
Females 65-74	176	1.1^{d}	0.7	0.1	5.5	51	0.9^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.32 Total Linolenic Acid Intake by Employment—Males (weighed sample)

Employment Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Full-time	472	$2.0^{a,b}$	1.8	0.5	10.7	76	2.1^{a}
Part-time, Self-employed & Retired	413	1.9^{a}	1.4	0.5	9.6	68	1.4^{a}
Unemployed, Homemaker & Student	87	2.6^{b}	2.9	0.1	8.7	7	2.5^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.33 Omega 6:Omega 3 Fat Ratio by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean	Standard Deviation	Minimum	Maximum	Cancer Concerned Sample Size (N)	Mean
Males 18-34	275	$7.1^{a,b}$	7.9	1.4	53.2	25	8.5^{a}
Males 35-49	262	$7.7^{a,b}$	8.1	1.5	41.1	50	10.2^{a}
Males 50-64	258	6.6^{a}	4.6	1.6	42.0	47	7.9^{a}
Males 65-74	180	$8.6^{a,b}$	6.8	1.9	129.6	30	9.0^{a}
Females 18-34	312	$8.1^{a,b}$	18.3	1.1	186.7	55	8.2^{a}
Females 35-49	290	$7.4^{a,b}$	6.8	0.3	50.3	97	9.1^{a}
Females 50-64	286	10.5^{b}	20.6	1.4	278.0	78	15.4^{a}
Females 65-74	176	$8.1^{a,b}$	6.4	1.2	92.7	51	7.4^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.36 Total Dietary Fibre Intake by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Males 18-34	275	20.2^{a}	15.6	0.7	108.2	25	27.9^{a}
Males 35-49	262	$17.1^{a,b}$	11.1	1.1	72.5	50	20.3^{b}
Males 50-64	258	17.0^{b}	7.5	0	54.7	47	$19.4^{b,c}$
Males 65-74	180	15.8^{b}	6.7	0.7	50.3	30	$18.4^{b,c}$
Females 18-34	312	13.4^{c}	9.3	0	76.5	55	14.5^{d}
Females 35-49	290	14.0^{c}	8.0	1.5	48.1	97	14.7^{d}
Females 50-64	286	13.3^{c}	5.5	2.8	51.3	78	14.1^{d}
Females 65-74	176	14.7^{c}	5.6	2.6	40.9	51	$17.9^{c,d}$

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.37 Total Dietary Fibre Intake by Income—Males (weighed sample)

Income Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
<$10,000-$19,999	146	16.0^{a}	9.5	1.1	51.9	17	$21.0^{a,b}$
$20,000-$29,999	107	18.9^{a}	12.1	0	58.9	15	14.3^{a}
$30,000-$39,999	138	17.3^{a}	8.9	0.7	46.9	20	$26.0^{a,b}$
$40,000-$49,999	94	19.1^{b}	11.2	4.9	72.5	20	25.0^{b}
$50,000-$59,999	96	$18.9^{a,b}$	11.5	2.2	59.3	16	$23.0^{a,b}$
$60,000 +	304	$19.1^{a,b}$	10.6	2.9	58.3	50	$22.6^{a,b}$
Do not know & refused	87	$17.5^{a,b}$	17.2	1.5	108.2	13	$16.1^{a,b}$

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.38 Total Dietary Fibre Intake by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	743	19.3^{a}	11.6	0.7	108.2	126	23.2^{a}
Smokers	229	15.1^{b}	9.8	0	53.4	25	18.9^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.39 Total Dietary Fibre Intake by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)	Cancer Concerned Sample Size (N)	Mean (g)
Non-smokers	807	14.6^{a}	7.7	2.2	72.7	233	15.4^{a}
Smokers	256	10.5^{b}	5.9	0	76.5	47	10.9^{b}

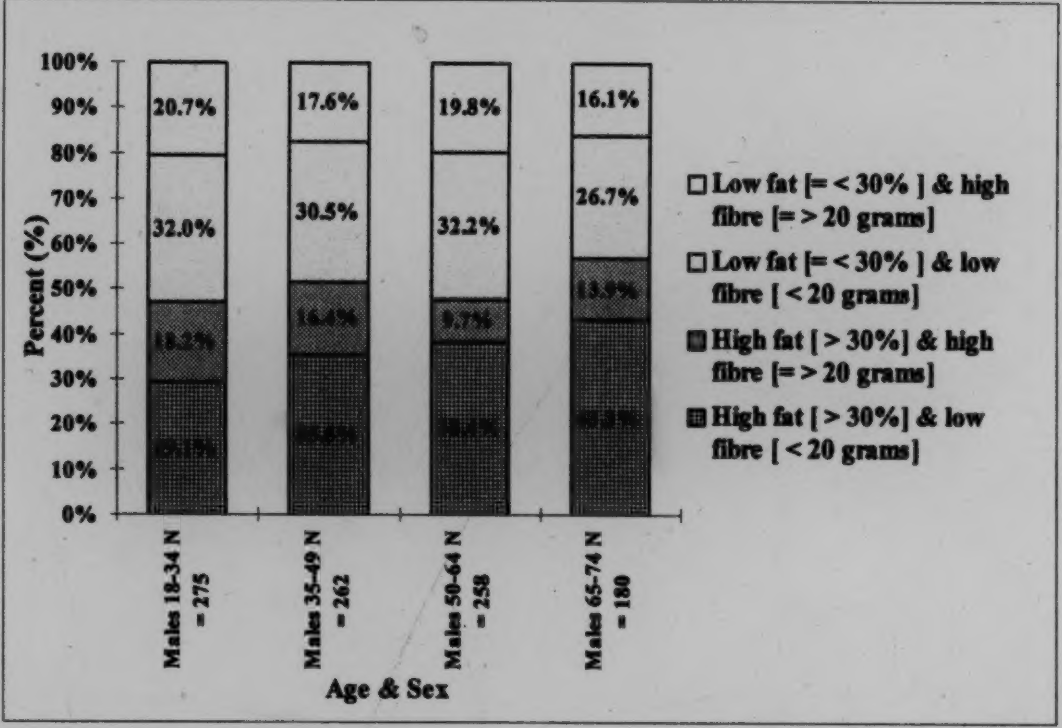
For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 4.43 Percent Energy From Carbohydrate by Age & Sex (weighed sample)

Age/Sex	Sample Size (N)	Mean (%)	Standard Deviation	Proportion That Consumed 55% or < Energy From Carbohydrates	Median (%)	Minimum (%)	Maximum (%)
Males 18-34	275	$50.5^{a,b,c}$	12.7	69.4%	49.9	17.9	78.3
Males 35-49	262	47.6^{a}	13.3	77.1%	47.2	20.6	83.5
Males 50-64	258	$49.1^{a,b}$	9.4	72.1%	48.5	17.5	91.6
Males 65-74	180	$48.8^{a,b}$	8.2	75.0%	48.5	17.2	84.1
Females 18-34	312	$53.7^{d,e}$	13.2	55.4%	53.3	24.3	82.7
Females 35-49	290	$49.5^{b,c}$	11.9	68.6%	49.9	21.3	82.5
Females 50-64	286	$52.0^{c,d}$	8.7	63.3%	51.2	21.4	85.5
Females 65-74	176	53.1^{e}	7.6	59.7%	53.0	30.8	87.0

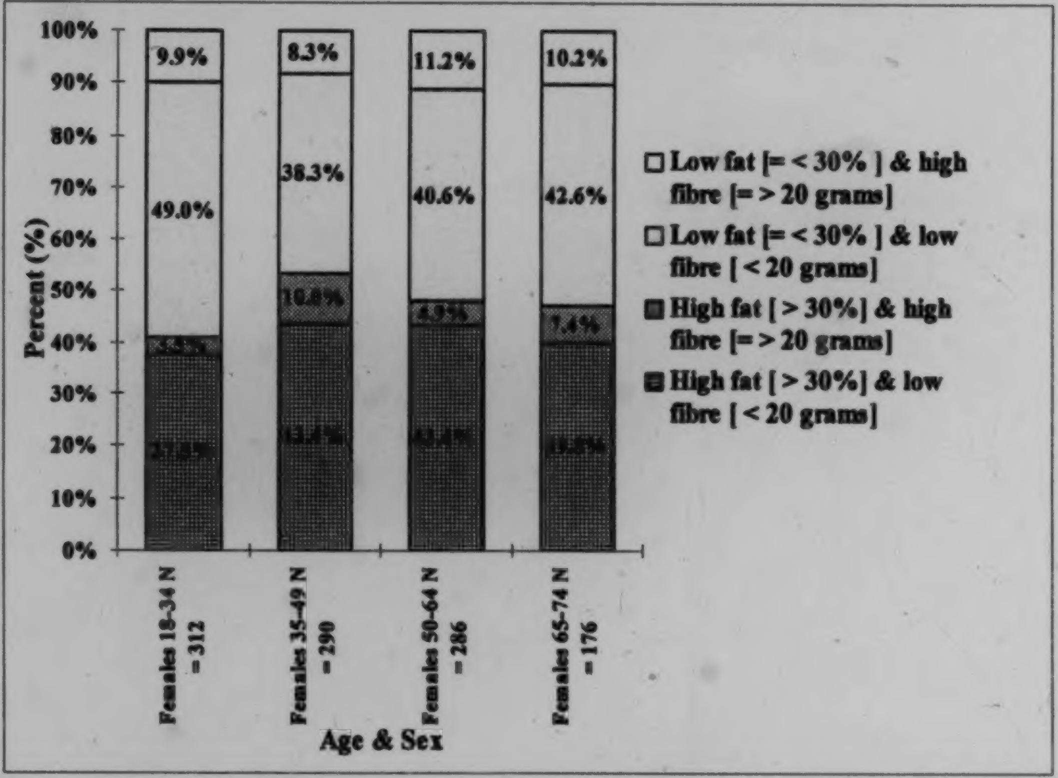
For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Figure 4.1 Dietary Fat & Fibre Consumption Among Males (un-weighed sample)



For each age sex grouping the shaded bars are significantly different Chi-square test for equal proportions $p < 0.001$

Figure 4.2 Dietary Fat & Fibre Consumption Among Females (un-weighed sample)



For each age sex grouping the shaded bars are significantly different Chi-square test for equal proportions $p < 0.001$

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CHAPTER FIVE

I. INTRODUCTION

A. DIETARY ANTIOXIDANTS

The American Cancer Society (1996) recommends that consumption of foods rich in antioxidants including vitamin A and vitamin C as well as carotenes be increased in the daily diet.

a) Literature Review

The evidence regarding the protective effect of diet against cancer is strongest for consumption of vegetables and fruit (IARC, 1997). Overall, observational epidemiologic evidence suggests that people who consume lower intakes of vegetables and fruit are at greater risk of developing cancer (Steinmetz and Potter, 1991). In Canada, evidence suggests that the consumption of a diet high in fresh vegetables and fruit is associated with reduced risk of cancers at various sites including salivary, nasopharyngeal and esophageal cancer (Canadian Cancer Registry, 1993). In addition, evidence suggests that vitamin deficiencies may increase the risk of lung cancer (Canadian Cancer Registry, 1993). In Canada, inadequate dietary fiber intake, particularly low intake of vegetables, have been suggested as additional risk factors in the etiology of colon cancer however, there is controversy (Canadian Cancer Registry, 1993).

Vegetables and fruit contain antioxidant micronutrients, such as vitamins A, C, E and carotenoids, selenium, zinc, copper, iron and manganese. Antioxidants support the body's defense system against free radical generation and reactive oxygen molecules (Young In and Mason, 1996). In addition, vegetables and fruit contain several non-nutritive components, such as phytochemicals, which are also thought to protect against oxidative damage.

b) Free Radical Theory and Antioxidant Defense

During energy production reactive oxygen molecules are generated (Halliwell, 1997). These unstable reactive oxygen molecules are most reactive when brought into contact with transition metal ions, such as iron and copper (Halliwell, 1997). Normally, a complex system of iron binding and storage proteins ensure transition metal ions are sequestered and therefore, unavailable to catalyze free radical products (Halliwell, 1997).

Theoretically, when these proteins become saturated the transition metal ions become available in free form and are capable of acting as pro-oxidants (Halliwell, 1997). Evidence suggests that pro-oxidants can initiate oxidative damage to DNA, protein and other macromolecules through free radical generation and can eventually contribute to several degenerative diseases, including cancer (Ames, 1983; Ames, 1989).

Antioxidant defense mechanisms oppose the effects of reactive oxygen molecules (Halliwell, 1997). Some antioxidant defenses occur naturally in the body and work in concert with hydrogen peroxide removing enzymes such (Halliwell, 1997). Other antioxidants must be obtained from the diet (Halliwell, 1997). Oxidative stress describes the imbalance that occurs between reactive oxygen molecules and antioxidant defense mechanisms (Halliwell, 1997). Oxidative stress can occur through inadequate dietary intake of antioxidants (Halliwell, 1997). Some of the antioxidants found in the diet appears in Table 5.1 and the proposed mechanisms of some antioxidants appears in Table 5.2.

Table 5.1 Potential Anti-carcinogens Found in Fruits and Vegetables

Carotenoids
Ascorbate
Tocopherols
Selenium
Folate
Dietary Fiber
Dithiothiones
Glucosinolate/Indoles
Isothiocyanates/Thiocyanates
Allium Compounds
Plant Sterols
Isoflavones
Protease Inhibitors
Coumarins

Adapted from Steinmetz and Potter, 1991

Table 5.2 Proposed Anti-carcinogenic Mechanisms of Dietary Antioxidants

	Antioxidants	Mechanisms
1)	Vitamins A, C, E & Carotenoids	Traps free radicals and reactive oxygen molecules
2)	Selenium, zinc, copper, iron & manganese	Essential components of antioxidant enzymes
	Other Effects	
3)	Vitamin A	Potentiation of immune response
4)	Vitamin C	Potentiation of immune response, inhibition of nitrosamine & nitrosamide formation
5)	Vitamin E	Potentiation of immune response, protection against lipid peroxidation in cell membranes, antiproliferations, reduction of mutation rates, decrease of nitrosamine formation

Adapted from: Machlin and Bendich,1987.

c) Cancer (all sites combined)

Evidence obtained from several epidemiologic studies suggest that consumption of vegetables and fruit are protective against cancer overall, rather than against specific cancer sites (IARC, 1997). Results reported from a cohort study of elderly individuals in Massachusetts, USA indicated odds ratios of 0.3 (0.1-1.0) for consumption of yellow and green vegetables, 0.3 (0.1-0.7) for strawberries, 0.5 (0.3-0.8) for tomatoes, and 0.6 (0.3-1.4) for dried fruit; respectively and risk of cancer (all sites combined) (Colditz et al., 1985). Results from another cohort study of elderly persons in California, USA suggest a weakly inverse association (OR = 0.8) (some statistically significant) between risk of cancer (all sites combined) and consumption of vegetables, fruits and dark green vegetables among women, whereas associations for men were reported to be null (Shibata et al., 1992). A summary of studies associating consumption of vegetables and fruit and risk of cancer at all sites appears in Table 5.3.

Table 5.3 Case-Control and Cohort Studies Investigating All Types Of Cancer [a] Showing Inverse, Null Or Positive Associations For Consumption Of Different Types of Fruit and Vegetables

	Relationship to Cancer Risk [b]					
	Number of Studies			% of Total Studies		
Variety or Fruit Category	Inverse	Null	Positive	Inverse	Null	Positive
Vegetables	59	6	9	80%	8%	12%
Fruit	36	15	5	64%	27%	9%
Raw Vegetables	40	4	2	87%	9%	4%
Cruciferous Vegetables	38	9	8	69%	16%	15%
Carrots	59	7	7	81%	10%	10%
Tomatoes	36	5	10	71%	10%	20%
Citrus Fruit	27	8	6	66%	20%	15%

a Table summarizes results from 217 case-control and cohort studies

b Tallied results include both statistically significant and non-significant associations

c Percentages may not add to 100% due to rounding

Source: AICR, 1997

d) Canadians and Consumption of Antioxidant Containing Vegetables and Fruit

In the Tracking Nutrition Trends Survey (1997) approximately 85% of Canadians reported nutrition was extremely, very or quite important when choosing foods to eat (TNT Survey, 1997). In the National Population Health Survey (1996) and the Tracking Nutrition Trends Survey (1997) approximately 37% of Canadian men and 46% of Canadian women were likely to report consuming more vegetables and fruit (National Population Health Survey, 1996; TNT Survey, 1997). Individuals more likely to consume low intakes of vegetables and fruit include current smokers, alcoholics, relatively inactive individuals and those who are retired or of lower socioeconomic status. Generally, the evidence for a protective effect of vegetables is stronger than that for fruit, and may in part reflect that vegetables are generally consumed in greater amounts than fruit and in whole form rather than in juice form (AICR, 1997).

e) Vitamins and Minerals and Cancer Risk

1. Vitamin A

The progression of malignant transformation entails a process characterized by the loss of cellular differentiation, and since vitamin A promotes this process, its dietary insufficiency has been implicated in the development of cancer at several sites (Kummet et al., 1983; Lacroix and Bhat, 1988). In studies using experimental models, evidence suggests that vitamin A deficiency impairs both humoral and cell mediated immunity (Ross, 1992). Research comparing the efficacy of retinoid analogs using animal models that have had skin cancer induced using promoting agents are more effective at inhibiting skin cancer than all-trans-retinoic acid (Boutwell, 1983). The effectiveness of vitamin A on the inhibition of tumors using systems other than the skin (stomach, esophagus, liver, pancreas and colon) have been ineffectual (Moon, 1989). Research in populations suggest that there is no relationship between retinol and risk of melanoma of the skin (AICR, 1997). Several epidemiologic studies have investigated the relationship between consumption of vitamin A and risk of cancer however, many studies have not distinguished between retinol and carotenoids (AICR, 1997).

2. β Carotene and Associated Substances

Between 500 and 600 carotenoids are currently known to exist in nature (Basu, 1996), and approximately 50 have some capacity to act as precursors of vitamin A (Bendich, 1988). Evidence obtained from experimental in vitro and in vivo studies suggest that, in addition to its pro-vitamin A status, β carotene may reduce the risk of cancer by enhancing immune response. Research suggests that β carotene may modulate immune function by enhancing T and B lymphocyte proliferative responses, stimulate effector T cell functions, enhance macrophage, cytotoxic T cell and natural killer cell tumoricidal capacities and increase production of particular interleukins (Bendich, 1988). In addition, β carotene is a unique antioxidant and a very effective quencher of singlet oxygen species (Bendich, 1988). Therefore, to reduce oxidative stress and enhance immune response a diet low in fat and high in fruit and vegetables, particularly foods containing β carotene is recommended.

3. Vitamin C

Observational epidemiologic evidence suggests that the risk of stomach cancer is lower in countries, such as Canada, where intake of vegetables and fruit rich in vitamin C is high (Canadian Cancer Registry, 1993). Evidence suggests that vitamin C, a water soluble nutrient, may reduce the risk of esophageal cancer by interfering with the metabolism of N-nitroso compounds (Ohshima and Bartsch, 1981). Research suggests that vitamin C may also reduce the risk of developing colorectal cancer. In a large scale study, involving a cohort from Australia, Kune et al (1987) reported that dietary intake of vitamin C was protective against colorectal cancer at intake levels exceeding 230 mg per day (Basu and Dickerson, 1996). Evidence further suggests that vitamin C offers a protective effect against lung cancer when consumed regularly in amounts exceeding 100 mg per day but is unlikely at amounts of 60 mg per day or less (Kromhout, 1987). Furthermore, Hoefel (1983) has reported that cigarette smoking is correlated with both high lung cancer incidence and low vitamin C status.

In general, vitamin C consumption has been associated with reduced cancer incidence due to its ability to block the formation of N-nitroso compounds and faecal mutagens, enhance immune system response, and increase the activity of detoxifying hepatic enzymes through an effect of cytochrome P450 (Newberne and Suphakarn, 1984). In Canada, groups that have been identified as potentially at risk for low vitamin C intake include smokers (smokers require 50% more vitamin C in addition to their respective Recommended Nutrient Intakes), older individuals and alcoholics (Basu and Dickerson, 1996).

Maintaining the steady state balance between rates of oxidative damage to DNA (bases) and rates of repair to DNA is essential for maintaining the integrity of genetic information (Demple and Harrison, 1994; Kasai, 1997). Evidence suggests that the generation of oxidation products throughout the life span is a major contributor to the development of some age related cancers including prostate, breast and colorectal cancer (Demple and Harrison, 1994; Kasai, 1997; Ames et al., 1993; Totter, 1980). Moreover, it has been suggested that consumption of 100-200 mg of vitamin C per day, an amount easily obtained by consuming five servings of vegetables and fruit daily, may be sufficient to maximize plasma and lymphocyte levels (Levine et al., 1998; Rumsey and Levine, 1998; Halliwell, 1999).

4. Vitamin E

The major function of vitamin E is the protection against free radical damage resulting from oxidation of polyunsaturated fatty acids (PUFAs) (Basu and Dickerson, 1996). Vitamin E interrupts the chain of free radical formation by reacting with free radicals and converting them into an innocuous species (Basu and Dickerson, 1996). Results from experimental studies in accordance with epidemiological observations suggest that high levels of vitamin E intake are associated with reduced risk of lung, esophageal and colorectal cancer (AICR, 1997). The requirement for vitamin E increases with the amount of dietary polyunsaturated fatty acid intake (Basu and Dickerson, 1996).

B. DIETARY SALT

The American Cancer Society (1996) recommends limiting the use of salt, consumption of salt-cured, smoked and nitrate-cured foods.

a) Literature Review

Current epidemiological evidence suggests that the consumption of salted foods, in addition to other nutrients may be implicated in the development of esophageal and gastric cancers (Reed, 1993; Correa, 1992; Blot, 1994). Greater incident and mortality rates for esophageal and gastric cancer have been well documented in regions where the consumption of pickled vegetables, salted fish and meat, and smoked foods is high (Reed, 1993; Correa, 1992; Blot, 1994; Greenwald et al., 1993), and the consumption of vegetables and fruit is low. Gastric carcinogenesis is perceived as a multistage process (Correa, 1992) therefore, dietary factors may affect carcinogenesis at different stages of the disease process. Although a factor may be only weakly associated with the overall process, it may nevertheless be of great importance in a particular phase of carcinogenesis (Hansson et al, 1994). Data obtained from 24 countries in the Intersalt study, found a correlation between urinary sodium excretion and stomach cancer mortality ($r = 0.7$ in men and women) (Joossens et al., 1993). Similar findings were reported for nitrate excretion, but the effect of salt/sodium was stronger (Joossens et al., 1996). Therefore, to reduce the risk of developing salt and or N-nitroso related cancers it is suggested that one limit the use of salt, consumption of salt-cured, smoked and nitrite-cured foods and consume at least 5 servings of vegetables and fruit daily.

II. RESULTS

A. Estimated Dietary Vitamin A Intake

1. Effect of Age and Sex on Dietary Vitamin A Intake

The estimated intake of vitamin A from dietary sources exceeded the Recommended Nutrient Intake (RNI) for both males and females on average (Table 5.4). However, among males and females of all ages the estimated median intake was below recommended levels. The average dietary intakes of vitamin A are skewed by individuals reporting higher intakes as many Alberta residents consumed below recommended levels on the day of the 24 hour dietary recall. Among Alberta residents who expressed a concern about cancer, the estimated median intake of vitamin A among males 18-34 years and 65-74 years, and among females aged 35-49 years, was above the RNI (Table 5.4). The maximum estimated intake of vitamin A from dietary sources ranged from approximately 5.9 times the RNI among females between 65-74 years to approximately 45.4 times the RNI among females aged 50-64 years (Table 5.4 appears at end of chapter 5).

2. Other Factors and their Relationship to Dietary Vitamin A Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the average estimated intake of vitamin A from dietary sources among males and or females in the Alberta population (Appendix A Tables 80-89).

B. Estimated Dietary Carotenoid Intake

1. Effect of Age and Sex on Dietary Carotenoid Intake

The average estimated intake of dietary carotenoids was similar among males and females between 18-74 years (Table 5.5). The median intake of dietary carotenoids was lower than the estimated average intakes indicating dietary intakes were skewed by some individuals consuming higher intakes of dietary carotenoids than others. Among Alberta residents that expressed a concern about cancer, the mean estimated dietary carotenoid intake was significantly ($p < 0.05$) higher among males between 65-74 years than among males between 18-34 years (Table 5.5 appears at end of chapter 5).

To further explore the proportion of the population that may not be consuming the suggested number of servings of vegetables and fruit, as represented by low intakes of carotenoids, the sample was divided into 3 tertiles, based on the estimated carotenoid intake from food (Table 5.6). More males between 18-49 years fell within the lowest tertile of dietary carotenoid intake than males between 50-74 years of age. Females between 18-34 years were more likely to consume lower amounts of carotenoids whereas, females between 50-64 years were more likely to consume higher levels of carotenoids (Table 5.6 appears at end of chapter 5).

2. Effect of Income on Dietary Carotenoid Intake

Among females who reported household income levels between $50,000-59,999 the average intake of dietary carotenoids was significantly ($p < 0.05$) higher compared to females who reported income levels of less than $10,000-29,999, $40,000-49,999 and among those who did not know or refused (Table 5.7). There was no significant ($p > 0.05$) effect of reported income level on the mean estimated intake of dietary carotenoids among males in the Alberta population (Appendix A Table). Among females who expressed a concern about cancer, the estimated mean intake of dietary carotenoids was significantly ($p < 0.05$) higher among females who reported income levels of $60,000 or greater compared to females who reported income levels between $20,000-29,999 and $40,000-49,999 (Table 5.7 appears at end of chapter 5).

3. Effect of Education on Dietary Carotenoid Intake

There was no significant ($p > 0.05$) effect of educational attainment on the mean estimated intake of dietary carotenoids among males and females in the Alberta population. To further explore the proportion of the population that may not be consuming the minimum suggested number of servings of vegetables and fruit, as represented by lower amounts of carotenoids, the sample was divided into 3 tertiles, based on the estimated carotenoid intake from food obtained from a 24 hour recall (Table 5.8). Females who reported some secondary education and less were significantly ($p < 0.03$) more likely to have intakes within the lowest tertile of carotenoid intake compared to approximately 28% of females who reported some and completed university (Table 5.8). There was no significant ($p > 0.05$) effect of education on the proportion of males that were estimated to consume low, medium or high intakes of carotenoids, based on tertiles (Table 5.8 appears at end of chapter 5).

4. Effect of Smoking on Dietary Carotenoid Intake

The average intake of carotenoids by female smokers was significantly ($p = 0.0051$) lower than that of non-smokers (Table 5.9). The median intake of dietary carotenoids among female smokers was approximately 50% less than that of non-smokers (Table 5.9). There was no significant ($p > 0.05$) effect of smoking on the mean estimated intake of dietary carotenoids among males in the Alberta population (Appendix A Table) (Table 5.9 appears at end of chapter 5).

To further explore the proportion of the population that may be consuming low intakes of carotenoids, the sample was divided into 3 tertiles, based on the estimated carotenoid intake from food (Table 5.10 & Table 5.11). Significantly ($p < 0.05$) more male smokers consumed within the lowest tertile of carotenoid intake than non-smokers (Table 5.10). Significantly ($p < 0.001$) more female smokers consumed within the lowest tertile of carotenoid intake than non-smokers (Table 5.11).

Table 5.10 Carotene Tertiles by Smoking Status—Males (un-weighed data)

Smoking Males	Non-smokers	Smokers
Sample Size (N)	743	229
Lowest Tertile (125.99 eq or less) (N = 321)	31%	39%
Middle Tertile (126.00-546.51 eq) (N = 327)	34%	33%
Highest Tertile (546.52 eq or greater) (N = 324)	35%	27%

Table 5.11 Carotene Tertiles by Smoking Status—Females (un-weighed data)

Smoking Females	Non-smokers	Smokers
Sample Size (N)	807	256
Lowest Tertile (125.99 eq or less) (N = 359)	30%	45%
Middle Tertile (126.00-546.51 eq) (N = 349)	34%	28%
Highest Tertile (546.52 eq or greater) (N = 355)	35%	27%

5. Other Factors and their Relationship to Dietary Carotenoid Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the mean estimated intake of carotenoids from food among males and or females in the Alberta population (Appendix A Tables 90-97).

C. Estimated Dietary Vitamin C Intake

1. Effect of Age and Sex on Dietary Vitamin C Intake

Males between 18-34 years consumed significantly ($p < 0.05$) higher intakes of vitamin C from dietary sources on average compared to all other age sex groups (Table 5.12). Among Alberta residents who expressed a concern about cancer, males and females between 65-74 years consumed significantly ($p < 0.05$) less vitamin C from dietary sources on average compared to males between 18-49 years (Table 5.12). The estimated mean and median intakes of vitamin C exceeded the Recommended Nutrient Intake for all age sex groups (Table 5.12). The median intake of vitamin C among the Alberta population was 80 mg per day (data not shown). Despite this, approximately 29% of Alberta residents did not meet their respective RNI for vitamin C from dietary sources (data not shown). The proportion of Alberta residents not meeting the RNI for vitamin C ranged from approximately 23% of females between 50-64 years to 35% of females between 18-34 years (Table 5.12 appears at end of chapter 5).

2. Effect of Marital Status on Dietary Vitamin C Intake

Single males consumed significantly ($p = 0.0036$) higher intakes of vitamin C from dietary sources on average than married males or males who reported being separated, divorced or widowed (Table 5.13). Results were similar among males who expressed a concern about cancer (Table 5.13). There was no significant ($p > 0.05$) effect of marital status on the mean intake of vitamin C from dietary sources among females in the Alberta population (Appendix A Table). The average intake of vitamin C from dietary sources exceeded 100 mg per day among males in the Alberta population (Table 5.13 appears at end of chapter 5).

3. Effect of Income on Dietary Vitamin C Intake

Males who reported income levels between $40,000-49,999 consumed significantly ($p < 0.05$) higher intakes of vitamin C from dietary sources on average compared to males who reported income levels between $20,000-39,999 (Table 5.14). The mean estimated vitamin C intake among males exceeded the recommended nutrient intake. There was no significant ($p > 0.05$) effect of reported income level on the mean estimated vitamin C intake among females in the Alberta population (Appendix A Table) (Table 5.14 appears at end of chapter 5).

4. Effect of Employment on Dietary Vitamin C Intake

Males who reported unemployment (homemaker or student) status consumed significantly ($p = 0.0001$) higher intakes of vitamin C from dietary sources on average than males who reported full-time employment or part-time employment (self-employment or retirement) status (Table 5.15). There was no significant ($p > 0.05$) effect of employment status on the average intake of vitamin C from dietary sources among females in the Alberta population (Appendix A Table). The average intake of vitamin C among males exceeded 100 mg per day (Table 5.15 appears at end of chapter 5).

5. Effect of Smoking on Dietary Vitamin C Intake

Male and female smokers consumed significantly ($p = 0.0001$) less vitamin C from dietary sources on average than non-smokers (Table 5.16 & Table 5.17). Among individuals who expressed a concern about cancer, the estimated intakes of vitamin C was higher on average compared to the general Alberta population (Table 5.16 & 5.17 appear at end of chapter 5).

Overall, regular smokers consumed lower intakes of vitamin C from dietary sources on average than non-smokers and occasional smokers. The median intake of dietary vitamin C among smokers fell below the RNI for males (60 mg) but met the RNI for females (45 mg) (Table 5.18).

Table 5.18 Estimated Vitamin C Intake by Smoking Status (weighed sample)

Smoking Status	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)
Regular smoker	485	86	100	46	0.0	738
Non-smoker	1476	124	121	88	0.2	1074
Occasional smoker	74	130	109	96	1.1	399
Refused	4	138	81	82	67.8	263

The proportion of individuals who did not meet their respective recommended nutrient intake for vitamin C from dietary sources ranged from 19.8% among female non-smokers to approximately 61.2% of males smokers (Table 5.19). Significantly more smokers ($p < 0.0001$) did not meet their respective recommended nutrient intake for vitamin C than non-smokers (Table 5.19).

Table 5.19 Vitamin C Recommended Nutrient Intake & Smoking Status (un-weighed data)

Smoking Status by Sex	Proportion that met RNI for vitamin C	Proportion that did not meet RNI for vitamin C
Proportion of non-smokers	79.5%	20.5%
Proportion of smokers	44.9%	55.1%
Proportion of male non-smokers	78.8%	21.2%
Proportion of male smokers	38.8%	61.2%
Proportion of female non-smokers	80.2%	19.8%
Proportion of female smokers	51.6%	48.4%

6. Other Factors and their Relationship to Dietary Vitamin C Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment or employment status on the mean estimated intake of dietary vitamin C among males and or females in the Alberta population (Appendix A Tables 98-102).

D. Estimated Dietary Salt Intake

1. Effect of Age and Sex on Dietary Salt Intake

The estimated salt intake by age & sex was approximately 3185 mg per day on average among residents between 18-74 years (data not shown). Males between 18-34 years of age consumed significantly ($p < 0.05$) higher intakes of salt on average than any other group (Table 5.20). The average salt intake declined significantly ($p < 0.05$) among males with increasing age. Females between 50-74 years consumed significantly ($p < 0.05$)

lower intakes of salt on average than females between 18-49 years (Table 5.20). Similar differences in the average intake of salt between age sex groupings were found among residents who expressed a concern about cancer (Table 5.20). The average salt intake did not exceed the recommendation (AICR, 1997) of no more than 6 grams per day (Table 5.20 appears at end of chapter 5).

2. Effect of Marital Status on Dietary Salt Intake

Single males consumed significantly ($p = 0.0001$) higher intakes of salt on average compared to married males (Table 5.21). There was no significant ($p > 0.05$) effect of marital status on the average intake of salt among females in the Alberta population (Appendix A Table) (Table 5.21 appears at end of chapter 5).

3. Effect of Income on Dietary Salt Intake

Males who reported household income levels between $20,000-29,999 consumed significantly ($p < 0.05$) less salt on average compared to males who reported income levels greater than $29,999 (Table 5.22). There was no significant ($p > 0.05$) effect of reported income level on the mean estimated intake of salt among females in the Alberta population (Appendix A Table) (Table 5.22 appears at end of chapter 5).

4. Effect of Employment on Dietary Salt Intake

Males who reported part-time employment (self-employment or retirement) status consumed significantly ($p = 0.0001$) lower intakes of salt on average compared to males who reported full-time employment or unemployment (homemaker or student) status (Table 5.23). There was no significant ($p > 0.05$) effect of employment on the average salt intake among females in the Alberta population (Table 5.23 appears at end of chapter 5).

5. Other Factors and their Relationship to Dietary Salt Intake

There was no significant ($p > 0.05$) effect of marital status, reported income level, educational attainment, employment status or smoking on the average intake of salt among males and or females in the Alberta population (Appendix A Tables 103-109).

III. ESTIMATED DIETARY ANTIOXIDANT AND SALT SUMMARY

Nutrient intakes of carotenoids and Vitamin C in the Alberta Nutrition Survey (1994) suggest that overall residents are not consuming the minimum number of recommended servings of vegetables and fruit. The estimated median intake of vitamin A among males and females of all ages from the 24 hour recall data did not meet the respective Recommended Nutrient Intake (Nutrition Recommendations, 1990). Males aged 18-49 years and females aged 18-34 years were more likely to consume low levels of dietary carotenoids than older respondents. Females between 18-34 years and males between 35-49 years were less likely to meet their respective RNI for vitamin C from dietary sources. In addition, males between 18-34 years and females between 18-49 years consumed significantly ($p < 0.05$) higher intakes of salt on average than older males and females between 50-74 years.

Separated, divorced and widowed males were more likely to consume low intakes of foods containing carotenoids and vitamin C and relatively moderate amounts of salt (3860 mg per day). Reported household income level was associated with the consumption of vegetables and fruit and salt intake. Females who reported higher household income levels ($50,000-59,999) consumed significantly ($p < 0.05$) higher intakes of foods containing carotenoids than females who reported lower income levels (less than $10,000-29,999). Whereas, males who reported higher household income levels ($40,000-49,999) consumed significantly ($p < 0.05$) higher intakes of foods containing vitamin C on average than males who reported lower income levels ($20,000-39,999). Males who reported household income levels between $20,000-29,999 consumed significantly ($p < 0.05$) lower intakes of salt on average than males who reported income levels greater than $29,999.

Females who reported some secondary education and less (40%) were more likely to consume low levels of carotenoids from dietary sources than females who reported having some or completed university (28%). Residents who reported smoking were also less likely to consume foods high in carotenoids and vitamin C. Female smokers consumed significantly ($p < 0.05$) lower intakes of carotenoids on average than non-smokers and male and female smokers consumed significantly ($p < 0.05$) lower intakes of vitamin C on average than non-smokers and were less likely to meet their respective RNI for vitamin C from dietary sources. There was no significant ($p > 0.05$) effect of smoking on the average salt intake among males and females in the Alberta population. Overall, this suggests that younger Alberta males (18-49 years) and females (18-34 years) consume lower levels of carotenoids than older males (50-74 years) and females (50-64 years) and higher intakes of salt. The socio-economic factors associated with low intake of foods containing antioxidants include lower reported income level and smoking among males and females and less education among females. Males who reported higher household income levels (> $29,999) were also more likely to consume higher average salt intakes.

IV. DISCUSSION

Findings from the Alberta Nutrition Survey (1994) suggest that residents are consuming less than the minimum recommended number of servings of vegetables and fruit as indicated by low dietary intakes of carotenoids and vitamin C. In the Alberta Nutrition Survey, the average estimated intakes of vitamin A ranged from 899 RE among females between 65-74 years to 1453 RE among males between 35-49 years. The estimated range of vitamin A from dietary sources is consistent with average intake levels reported in the Nova Scotia Nutrition Survey (1990), which employed a similar methodology. In the Nova Scotia Nutrition Survey (1990) it was reported that the average daily intake of vitamin A ranged between 844 RE to 1628 RE vitamin A per day. Pre-formed vitamin A is found exclusively in foods of animal origin such as fish oils, liver, butter fat, fortified margarine and egg yolk (Gibson, 1990). Vitamin A is often subject to day to day variations in intake and therefore, the data obtained from 24 h intake should be interpreted with caution (Mahalko et al., 1985). Follow up studies employing other methodologies are need. Future analysis of the food frequency data from the Alberta Nutrition study can be used to help obtain a better estimate of vitamin A intake in the population.

Low socio-economic status is generally associated with high risk of esophageal and stomach cancers (Howson et al., 1986) and may be due to poor sanitation conditions, lack of refrigeration and or low consumption of vegetables and fruit. In the Alberta Nutrition Survey, females who reported lower levels of education and lower household income levels were more likely to consume lower intakes of carotenoids from dietary sources. Males who reported lower income levels consumed lower intakes of foods containing vitamin C. This suggests that low socio-economic status and or the high costs associated with vegetables and fruit in Alberta may prevent some individuals from consuming the recommended number of servings of vegetables and fruit daily.

The average intake of vitamin C from dietary sources among Alberta residents was consistent with levels reported in other provincial health surveys. In the Alberta Nutrition Survey the average intake of vitamin C ranged from 93 mg to 150 mg per day. In the Nova Scotia Nutrition Survey (1990) it was reported that the mean daily intake of vitamin C was higher than the RNI and ranged between 74 mg to 115 mg per day. In the Ontario Health Survey (1990) the average intake of vitamin C was approximately 148 mg per day. Despite this mean intake, approximately 29% of Alberta residents did not meet their respective RNI for vitamin C from dietary sources compared to less than 10% of residents from Ontario (Ontario Health Survey, 1990).

It has been suggested that smokers should increase their intake of vitamin C by 50% (Nutrition Recommendations, 1990). The groups who reported smoking at a higher rate in the Alberta population include males between 35-49 years (31%), separated, divorced and widowed males (37%), and females who reported some secondary education and less (33%). Approximately 33% of males between 35-49 years did not meet the RNI for vitamin C from dietary sources. Separated, divorced and widowed males consumed significantly lower intakes of carotenoids than married males and significantly less vitamin C on average than single males. Females who reported some secondary education and less consumed significantly lower intakes of carotenoids than females who reported some and completed university. This suggests that Alberta residents who reported smoking may be at an even greater disadvantage in terms of the protection offered by antioxidants against free radical damage due to lower intakes of dietary carotenoids and foods containing vitamin C.

In the ANS, some groups consumed higher average intakes of salt. However, the average intake of salt for all age sex groups did not exceed 6000 mg per day, as recommended by the American Institute for Cancer Research (1997), the World Health Organization (1991) and the National Academy of Sciences (1989). Males between 18-34 years, single males and males who reported household income levels between $30,000 and $60,000 or greater consumed significantly ($p < 0.05$) higher intakes of salt on average and were also more likely to report eating at fast food restaurants 1-2 times per week (see Chapter 7 Table). Unfortunately, the consumption of charred, cured and smoked meats was not estimated in the ANS (1994) and therefore, the intake of nitrites and or nitrates could not be determined.

Vitamin E and selenium are important antioxidants that have been associated with a reduced risk of developing cancer, particularly cancers of the gastrointestinal tract. Unfortunately, the dietary intake of vitamin E and selenium could not be estimated in the Alberta Nutrition Survey as the database used would have underestimated the intake of these nutrients.

The proportion of Alberta residents who reported using supplements is pending further analysis. Currently, it is unknown what proportion of Alberta residents use vitamin and mineral supplements, the distribution and frequency of supplementation, and the potential for misuse. Therefore, the estimated intakes of vitamin A, carotenoids and vitamin C in this report are based exclusively on dietary sources and do not include supplemental intakes. In the Nova Scotia Nutrition Survey (1990) approximately 18% of residents reported using supplements. In the United States, it has been estimated that during any given year approximately 50% of the adult population are using supplements (Block et al., 1988; Kim et al., 1993; Koplan et al., 1986; Subar and Block, 1990) and that between 23% and 35% of the adult population are using vitamin and mineral supplements on a daily basis (Block et al., 1988; Kim et al., 1993; Koplan et al., 1986; Subar and Block, 1990). Results obtained from several studies suggest that nutritional supplements are more likely to be used by Caucasian women (Gray et al., 1996) and individuals 55 years of age and older (Subar and Block, 1990), those with more education (Gray et al., 1996), and those who rate their health as good or excellent (Gray et al., 1996), those who consume less alcohol (Subar and Block, 1990) and non-smokers (Subar and Block, 1990).

The American Institute for Cancer Research (1997) currently recommends that North Americans consume at least five servings of vegetables and fruit daily, and that the intake of salt not exceed 6000 mg per day. Although the Alberta Nutrition Survey only provides estimations of the dietary intake of specific nutrients, such as vitamin A, carotenoids and vitamin C, it has been suggested that these estimates can be used as a predictor of vegetable and fruit consumption (AICR, 1997). If current recommendations for fruit and vegetable consumption were followed, individuals should be consuming approximately

200 to 280 mg of vitamin C per day (Ausman, 1999). Our data finds that residents are consuming less than 120 mg of vitamin C per day. Alberta residents who are less likely to consume the minimum number of recommended servings of vegetables and fruit daily, particularly foods high in carotenoids and vitamin C, include males and females between 18-34 years, males and females who reported lower household income levels, females who reported some secondary education and less, and males and females who reported smoking. Although Alberta residents consumed average salt intakes below recommended levels, residents that reported eating at fast food restaurants 1-2 times per week, including males between 18-34 years, single males and males that reported household income levels between $30,000 and $60,000 or greater, consumed significantly ($p < 0.05$) higher intakes of salt on average.

Overall, results from the Alberta Nutrition Survey suggest that males and females are consuming a diet low in fruit and vegetables. Diets low in fruit and vegetables have been associated with a higher risk of developing some forms of cancer. Eating at fast food restaurants was associated with higher intakes of salt and was associated with males between 18-34 years, single males and males with higher incomes. Males and females who reported smoking were more likely to consume a diet low in carotenoids and vitamin C and therefore, fruit and vegetables and these dietary practices may make them more 'susceptible' to developing some forms of cancer. Results from the Alberta Nutrition Survey suggest that educational campaigns that promote alternate, low cost vegetables and fruit may be warranted. In addition, opportunities exist for tobacco manufacturers to promote the importance of increased consumption of vegetables and fruit among individuals who smoke.

Table 5.4 Dietary Vitamin A Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (eq)	Standard Deviation	Median (eq)	Minimum (eq)	Maximum (eq)	Cancer Concerned Sample Size (N)	Mean (eq)
Males 18-34	275	$1341^{a,b}$	1831	881	6	20920	25	$1207^{a,b}$
Males 35-49	262	$1453^{a,b}$	3253	816	56	28790	50	2793^{a}
Males 50-64	258	1292^{b}	1360	824	85	34115	47	$1106^{a,b}$
Males 65-74	180	1329^{b}	1412	901	13	18951	30	1583^{a}
Females 18-34	312	1100^{a}	1688	591	3	11009	55	1051^{b}
Females 35-49	290	$1085^{a,b}$	1119	691	39	13783	97	$1140^{a,b}$
Females 50-64	286	$1182^{a,b}$	1372	765	7	36336	78	$1297^{a,b}$
Females 65-74	176	899^{a}	609	710	92	4717	51	999^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.5 Dietary Carotene Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (eq)	Standard Deviation	Median (eq)	Minimum (eq)	Maximum (eq)	Cancer Concerned Sample Size (N)	Mean (eq)
Males 18-34	275	677^{a}	1409	233	0	10463	25	546^{a}
Males 35-49	262	711^{a}	1255	227	0	11628	50	$998^{a,b}$
Males 50-64	258	772^{a}	894	299	9	7676	47	$647^{a,b}$
Males 65-74	180	725^{a}	752	317	1	7067	30	1091^{b}
Females 18-34	312	719^{a}	1656	180	0	10593	55	$682^{a,b}$
Females 35-49	290	730^{a}	1062	288	0	13597	97	$774^{a,b}$
Females 50-64	286	682^{a}	833	336	1	9676	78	$486^{a,b}$
Females 65-74	176	569^{a}	596	293	6	4536	51	$643^{a,b}$

Table 5.6 Carotene Tertiles by Age & Sex (un-weighed data)

Carotene Tertiles Age & Gender	Males 18-34	Males 35-49	Males 50-64	Males 65-74	Females 18-34	Females 35-49	Females 50-64	Females 65-74
Sample Size (N)	275	262	258	180	312	290	286	176
Lowest Tertile (125.99 eq or less) (N = 680)	35%	36%	30%	30%	41%	33%	26%	35%
Middle Tertile (126.00-546.51 eq) (N = 680)	38%	33%	32%	32%	33%	32%	34%	32%
Highest Tertile (546.52 eq or greater) (N = 679)	27%	31%	38%	38%	26%	35%	40%	33%

Chi-square analysis indicates that there is an effect between age and sex and the estimated carotenoid intake from dietary sources ($p < 0.009$).

Table 5.7 Dietary Carotene Intake by Income—Females (weighed sample)

Income Females	Sample Size (N)	Mean (eq)	Standard Deviation	Median (eq)	Minimum (eq)	Maximum (eq)	Cancer Concerned Sample Size (N)	Mean (eq)
<$10,000-$19,999	192	596.9^{a}	701.6	280	1.0	9676.2	40	711^{a,b}
$20,000-$29,999	127	733.4^{a}	828.5	239	0	5067.6	26	403^{a}
$30,000-$39,999	135	833.2^{a,b}	1646.7	229	2.8	10592.8	41	671^{a,b}
$40,000-$49,999	117	568.2^{a}	911.1	215	1.5	4191.1	24	552^{a}
$50,000-$59,999	102	1134.2^{b}	2181.3	378	4.8	9900.7	36	607^{a,b}
$60,000 +	231	654.1^{a,b}	963.6	287	0	13597.3	67	945^{b}
Don't know & refused	158	505.8^{a}	676.9	234	2.4	6399.4	46	524^{a,b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.8 Carotene Tertiles by Education—Females (un-weighed data)

Education Females	Some secondary & less	Completed secondary	Some & completed trade/community college	Some & completed university	Other education or training
Sample Size (N)	273	251	275	258	6
Lowest Tertile (125.99 eq or less) (N = 359)	40%	34%	32%	28%	50%
Middle Tertile (126.00-546.51 eq) (N = 349)	27 %	37%	35%	33%	33%
Highest Tertile (546.52 eq or greater) (N = 355)	33%	28%	33%	39%	17%

Chi-square analysis indicates that there is an effect between educational attainment and the estimated carotenoid intake from dietary sources ($p < 0.032$).

Table 5.9 Dietary Carotene Intake by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (eq)	Standard Deviation	Median (eq)	Minimum (eq)	Maximum (eq)	Cancer Concerned Sample Size (N)	Mean (eq)
Non-smokers	807	774^{a}	1272	300	0	13597	233	671^{a}
Smokers	256	450^{b}	684	147	1	5676	47	703^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.12 Dietary Vitamin C Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Percent that did not meet RNI	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Males 18-34	275	26.5%	150 ^{a}	197	88	1	1074	25	226 ^{a}
Males 35-49	262	33.2%	112 ^{b}	138	82	0	854	50	165 ^{a,b}
Males 50-64	258	30.0%	107 ^{b}	87	79	0	741	47	126 ^{b,c}
Males 65-74	180	29.4%	93 ^{b}	59	78	2	649	30	88 ^{c}
Females 18-34	312	35.3%	105 ^{b}	111	65	0	500	55	145 ^{b,c}
Females 35-49	290	25.2%	105 ^{b}	102	80	1	829	97	111 ^{b,c}
Females 50-64	286	23.1%	106 ^{b}	80	79	4	599	78	123 ^{b,c}
Females 65-74	176	25.6%	93 ^{b}	59	85	2	542	51	98 ^{c}

Proportion that did not meet respective RNI for vitamin C from dietary sources is based on un-weighed data.

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.13 Dietary Vitamin C Intake by Marital Status—Males (weighed sample)

Marital Status Males	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Single	176	156.2 ^{a}	218.3	85	0.7	1073.7	17	266 ^{a}
Married	693	113.5 ^{b}	112.8	82	0.1	854.3	119	140 ^{b}
Separated, divorced & widowed	103	112.8 ^{b}	102.9	68	2.4	457.5	15	108 ^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.14 Dietary Vitamin C Intake by Income—Males (weighed sample)

Income Males	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
<$10,000-$19,999	146	117.9 ^{a,b}	154.9	71	0.1	854.3	17	180 ^{a,b}
$20,000-$29,999	107	101.8 ^{a}	100.9	61	0.8	558.9	15	63 ^{a}
$30,000-$39,999	138	100.6 ^{a}	93.8	69	1.7	542.7	20	181 ^{a,b}
$40,000-$49,999	94	132.9 ^{b}	163.5	94	2.2	1073.7	20	126 ^{b}
$50,000-$59,999	96	147.2 ^{a,b}	163.7	84	1.8	762.0	16	227 ^{a,b}
$60,000 +	304	134.6 ^{a,b}	141.7	93	1.8	854.3	50	188 ^{a,b}
Don't know & refused	87	115.7 ^{a,b}	130.9	76	0.2	608.7	13	77 ^{a,b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.15 Dietary Vitamin C Intake by Employment—Males (weighed sample)

Employment Males	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Full-time	472	129.7 ^{a}	146.9	87	0.2	1073.7	76	152 ^{a}
Part-time, Self-employed & Retired	413	101.9 ^{a}	92.8	75	0.1	762.0	68	131 ^{a}
Unemployed, Homemaker & Student	87	160.9 ^{b}	228.8	93	1.1	738.2	7	401 ^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.16 Dietary Vitamin C Intake by Smoking Status—Males (weighed sample)

Smoking Males	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Non-smokers	743	135 ^{a}	141	90	0	1074	126	176 ^{a}
Smokers	229	91 ^{b}	122	52	0	738	25	147 ^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.17 Dietary Vitamin C Intake by Smoking Status—Females (weighed sample)

Smoking Females	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Non-smokers	807	113 ^{a}	97	87	1	829	233	124 ^{a}
Smokers	256	74 ^{b}	73	46	0	533	47	116 ^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.20 Salt Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Males 18-34	275	4478 ^{a}	2966	474	17529	25	4745 ^{a}
Males 35-49	262	3755 ^{b}	2666	370	15216	50	4003 ^{b}
Males 50-64	258	3507 ^{b}	1440	292	9210	47	3349 ^{b}
Males 65-74	180	2913 ^{c}	928	261	8460	30	2786 ^{b,c}
Females 18-34	312	2879 ^{c}	1747	128	9883	55	2960 ^{b,c}
Females 35-49	290	3032 ^{c}	3411	134	29430	97	3392 ^{b,c}
Females 50-64	286	2405 ^{d}	953	299	7954	78	2223 ^{c}
Females 65-74	176	2145 ^{d}	587	494	5592	51	2143 ^{c}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.21 Salt Intake by Marital Status—Males (weighed sample)

Marital Status Males	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Single	176	4407^{a}	3549	292	17529	17	5094^{a}
Married	693	3751^{b}	1908	370	13828	119	3480^{a}
Separated, divorced & widowed	103	$3861^{a,b}$	1991	261	14754	15	4901^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.22 Salt Intake by Income—Males (weighed sample)

Income Males	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
<$10,000-$19,999	146	$3826^{a,b}$	2325	566	9925	17	4743^{a}
$20,000-$29,999	107	3767^{a}	1600	261	7511	15	4007^{a}
$30,000-$39,999	138	4367^{b}	2308	412	15216	20	5895^{a}
$40,000-$49,999	94	4133^{b}	2567	292	14754	20	3863^{a}
$50,000-$59,999	96	3586^{b}	1988	548	15009	16	3608^{a}
$60,000 +	304	3897^{b}	2315	370	11645	50	3574^{a}
Do not know & refused	87	$4006^{a,b}$	2991	462	17529	13	3200^{a}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 5.23 Salt Intake by Employment—Males (weighed sample)

Employment Males	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)	Cancer Concerned Sample Size (N)	Mean (mg)
Full-time	472	4022^{a}	2413	370	15216	76	$4410^{a,b}$
Part-time, Self-employed & Retired	413	3657^{b}	1704	261	10371	68	2926^{a}
Unemployed, Homemaker & Student	87	4250^{a}	3781	566	17529	7	5488^{b}

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

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CHAPTER SIX

I. INTRODUCTION

A. ALCOHOL CONSUMPTION

The American Cancer Society (1996) recommends abstaining from alcohol. If alcohol is to be consumed it is suggested that men consume no more than the equivalent of 2 drinks per day (or less than 5% total energy intake), and that women consume no more than 1 drink per day (or less than 2.5% total energy intake).

a) Literature Review

Evidence suggests that the relationship between alcohol consumption and coronary heart disease in both men and women is "U" shaped (Doll et al., 1994; Fuchs et al., 1995). The descending part of the "U" shaped curve may be attributed to a greater proportion of wine drinkers whereas the ascending curve may be associated with heavy spirit drinkers (Grønbaek et al., 1995). Evidence suggests that the ascending part of the "U" shaped curve may be associated with a greater frequency of diseases, injuries and suicides (Grønbaek et al., 1995). Alternatively, other characteristic components of alcoholic beverages other than ethanol may result in different (health) effects (Dorfman et al., 1985). Studies have suggested that consumption of alcohol may be beneficial due to its association with higher HDL/LDL cholesterol ratios and its inhibitory effect on platelet aggregation (Männistö et al., 1997).

Among working men in Western Australia the consumption of wine was associated with healthier dietary choices. These dietary choices included greater consumption of vegetables, fruit and bread, while those who preferred beer consumed more meat, fried foods, eggs and salt (Burke et al., 1995). Among women the consumption of wine has been associated with higher intakes of antioxidants in general and carotenoids in particular (Männistö et al., 1997).

Conversely, the consumption of alcohol has been positively associated with increased risk of cancer at several sites. Table 6.1 illustrates the types of cancer associated with alcohol consumption among Canadian men and women.

Table 6.1 Cancer Incidence at Various Sites Associated with Alcohol Consumption

Cancer Site	Incidence		Alcohol & Associated Risk Factors[1]	References
	Men	Women		
Lip	1.3%	0.2%	[2] Pipe Smoking & [2]Alcohol	Baker, 1980; Douglas & Gammon, 1984; Lindqvist, 1979; Spitzer et al., 1975
Mouth, Tongue & Pharynx	3.0%	1.5%	[3]Alcohol & [3] Tobacco	Canadian Cancer Registry, 1993
Esophagus	1.3%	0.6%	[3]Alcohol, [3]Tobacco & [3] Dietary Deficiencies	Roush et al., 1987
Rectum	-	-	[2] Alcohol	Schottenfeld & Fraumeni, 1982
Pancreas	2.7%	2.7%	[4]Smoking & [2]Alcohol	Roush et al., 1987
Larynx	2.1%	0.4%	[3]Smoking & [3]Alcohol	Doll, 1982
Female Breast	-	27.1%	[2] Alcohol	Canadian Cancer Registry, 1993
Primary Liver	-	-	[3] Alcohol	Miller et al., 1994

1 Only Risk Factors Associated with Alcohol Consumption are Included

2 Suspected Risk Factor

3 Major Risk Factor

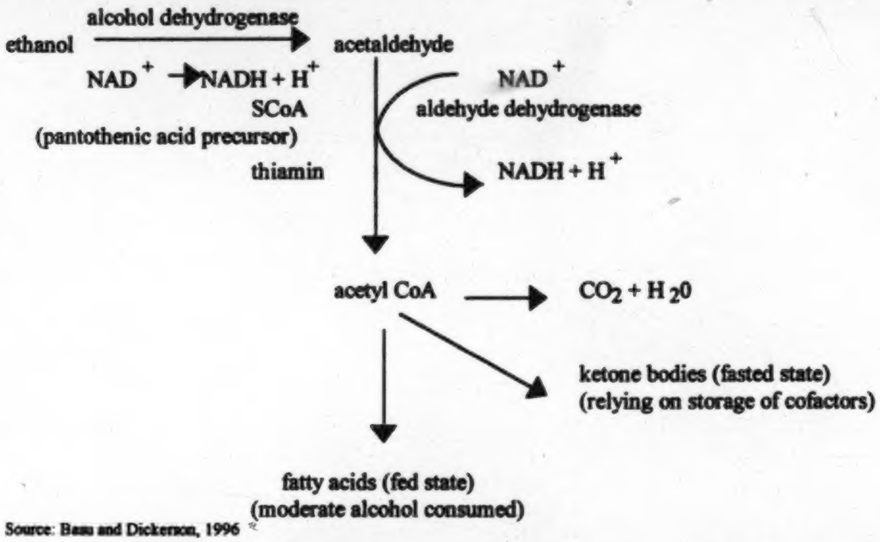
4 Established Risk Factor

The American Cancer Society (1996) defines an alcoholic beverage as 12 ounces of regular beer, 5 ounces of table wine and 1.5 ounces of 80 proof distilled spirits. Alcohol provides approximately 7 calories per gram of intake. Alcoholic beverages provide additional calories but relatively few nutrients; therefore individuals who consume alcohol in excess may be substituting alcohol for nutrient dense foods (The American Cancer Society, 1996).

B. METABOLISM OF ALCOHOL

Although alcoholic beverages contain no proteins, vitamins or minerals, consumed in moderation alcohol is metabolized as a nutrient (Basu and Dickerson, 1996). The oxidation of alcohol occurs primarily in the liver cells (Hamilton and Gropper, 1987). Alcohol (ethyl alcohol or ethanol), the active ingredient of all alcoholic beverages, is metabolized in the liver as illustrated in Figure 6.1.

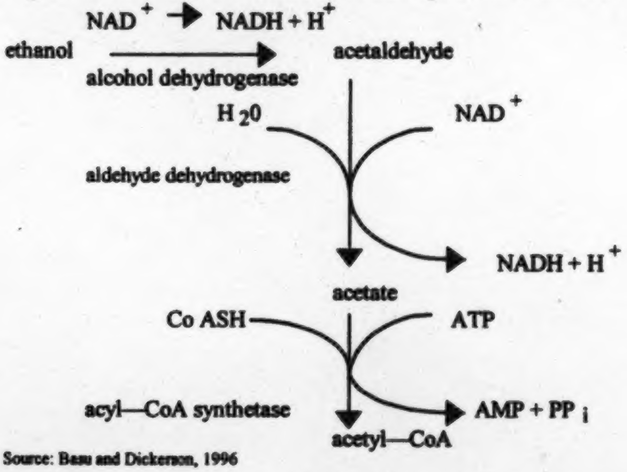
Figure 6.1 Metabolic Pathway for the Oxidation of Alcohol & Associated Cofactors


alcohol dehydrogenase
ethanol
acetaldehyde
NAD+ → NADH + H+
SCoA
(pantothenic acid precursor)
thiamin
NAD+
aldehyde dehydrogenase
NADH + H+
acetyl CoA
CO2 + H20
ketone bodies (fasted state)
(relying on storage of cofactors)
fatty acids (fed state)
(moderate alcohol consumed)

Source: Basu and Dickerson, 1996

The conversion of alcohol to acetyl CoA is partly responsible for the development of the degenerative changes in liver, defined as fatty liver. In addition, waste products accumulate and toxicity may result (Hamilton and Gropper, 1987). Generally, women tolerate alcohol less well than men due to their smaller size and lower levels of aldehyde dehydrogenase in the stomach, and greater ability to absorb alcohol (The American Cancer Society, 1996). The preferred metabolic pathway for the oxidation of alcohol appears in Figure 6.2.

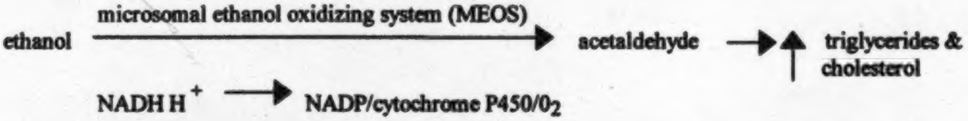
Figure 6.2 Preferred Metabolic Pathway for the oxidation of Alcohol


NAD+ → NADH + H+
ethanol
acetaldehyde
alcohol dehydrogenase
H 20
NAD+
aldehyde dehydrogenase
NADH + H+
acetate
Co ASH
ATP
acyl—CoA synthetase
AMP + PP i
acetyl—CoA

Source: Basu and Dickerson, 1996

Due to competitive inhibition, alcohol is preferentially metabolized in the presence of particular nutrients, especially vitamin A (Basu and Dickerson, 1996). Consumed in excess alcohol is metabolized as a drug by the microsomal ethanol oxidizing system (MEOS), an alternative pathway for the oxidation of alcohol to acetaldehyde (Figure 6.3; Basu and Dickerson, 1996). The metabolism of alcohol via ***MEOS*** occurs when the alcohol dehydrogenase pathway is exhausted due to an inadequate supply and or depletion of B vitamins (Basu and Dickerson, 1996). If acetaldehyde is allowed to accumulate, toxic effects may result (Hamilton and Gropper, 1987) and interfere with the activation of vitamins in the liver (Basu and Dickerson, 1996). The vitamins particularly affected by this mechanism include thiamin, vitamin B_6, folic acid and vitamin D (Basu and Dickerson, 1996).

Figure 6.3 Microsomal Ethanol Oxidizing System (MEOS) for the Metabolism of Alcohol



C. EXCESS CONSUMPTION OF ALCOHOL AND ASSOCIATED EFFECTS ON MICRONUTRIENT STATUS

Among people who chronically abuse alcohol, vitamin deficiencies may occur due to dietary insufficiency, malabsorption, increased excretion, and or a reduced conversion to the active form (Basu and Dickerson, 1996). B vitamin deficiencies, including that of folic acid have been reported to be the most common among alcoholics (Basu and Dickerson, 1996). Consumption of alcohol has been reported to cause inflammation of the stomach, pancreas and intestine, and may therefore interfere with the normal processes of digestion and absorption (Basu and Dickerson, 1996). In addition, symptoms of vitamin A deficiency, such as night blindness, have been reported among alcoholics with liver damage (Leo and Lieber, 1982), and Vitamin A deficiency places individuals at a greater risk of developing cancer (Table 6.2; Lieber et. al. 1979). Alcohol in excess quantities can also interfere with the metabolism of vitamin D as the liver is important for the storage and metabolism of this fat soluble vitamin as well (Basu and Dickerson, 1996).

Table 6.2 Consumption of Alcohol and Possible Mechanisms Associated with the Development of Cancer

	Possible Mechanisms
a)	Direct local effects of alcohol on the upper gastrointestinal tract
b)	Presence of low levels of carcinogens in alcoholic beverages i.e. nitrosamines[1], polycylic hydrocarbons[2] and asbestos fibers[3]
c)	Induction of microsomal enzymes involved in carcinogen metabolism (procarcinogens ⟶ carcinogens) i.e. nitrites ⟶ nitrosamines
d)	Cellular injury produced by alcohol and its metabolites
e)	Nutritional disturbances frequently associated with alcohol abuse i.e. malnutrition[4] and compromised immune function[5] i.e. decreased immune surveillance, [6] modified Kuppfer cell functions,[6]T and B cell deficiencies[7]

Adapted from Lieber et al., 1979

1Walker et al., 1979

2Masuda et al., 1966

3Wehman and Plantholt, 1974

4Mohs and Watson, 1989

5Petro et al.,1984

6Mufti et al., 1989

7Johnson et al.,1981

D. EPIDEMIOLOGIC EVIDENCE BETWEEN ALCOHOL AND CANCER

In 1957, Wynder and Bross demonstrated that heavy drinkers who consume highly concentrated alcoholic beverages may experience an approximate 10-12 fold increased risk of developing a variety of head and neck malignancies, such as those of the mouth, pharynx and larynx. Tuyns (1978 & 1979) demonstrated that consumption of alcohol in amounts greater than 80 grams per day (which is approximately equivalent to consuming one bottle of wine), increases the risk of developing esophageal cancer by a factor of 18, while smoking more than 20 cigarettes per day without consuming alcohol increases the risk of esophageal cancer by a factor of five. Together, both the consumption of alcohol and use of tobacco enhances the risk of esophageal cancer synergistically, increasing the risk by a factor of 44 (Tuyns, 1978 & 1979). In 1990, Maier et al observed that 90% of all patients with malignancies of the head and neck region regularly consumed almost two times the amount of alcohol per day compared with the control group.

1. Breast and Prostate Cancer

Evidence suggests that alcohol consumption moderately increases the risk of breast cancer (Willett et al., 1987; Swanson et al., 1997; Smith-Warner et al., 1998). In a pooled analysis from 6 prospective cohort studies an increment of 10 grams per day of alcohol consumption was associated with a 9% increased risk of breast cancer (Smith-Warner et al., 1998). Research suggests that high intakes of alcohol may increase the risk of breast cancer by increasing endogenous estrogen levels (AICR, 1997).

The association between alcohol consumption and risk of prostate cancer is less consistent. Well established risk factors for prostate cancer include age, ethnicity and family history (Key, 1995). Several case-control studies (Nakata et al., 1993; Pawlega et al., 1996; Slattery et al., 1993; Tavani et al., 1994; Wei et al., 1994; Breslow et al., 1998) and cohort studies among general populations (Breslow et al., 1998; Gronberg et al., 1996; Hiatt et al., 1994; Le Marchand et al., 1994) have not reported significant associations. Only two population based cohort studies, one by Tonnesen et al in Denmark (Tonneson et al., 1994), and the other by Adami et al in Sweden (Adami et al., 1992) have reported an increased risk of prostate cancer among alcoholics. The difficulty in determining an association between risk of prostate cancer and alcohol consumption is because the etiology of prostate cancer is poorly understood (Freudenheim et al., 1991; Mason et al., 1996) and may take several decades to develop (Breslow et al., 1999). In addition, studies that report different effects of alcohol consumption on prostate cancer may vary as a function of methods, time and dose.

2. Colon Cancer

Inadequate consumption of dietary folate has been associated with increased risk of colon cancer in epidemiologic studies, particularly among individuals who regularly consume alcohol (Giovannucci et al., 1993; Giovannucci et al., 1995; Freudenheim et al., 1991). In a prospective study consisting of 490,000 men and women, between 30 and 104 years of age, reported alcohol consumption and mortality rates (cause specific and all cause mortality) were assessed. Overall, mortality rates were lowest among men and women who reported consuming approximately one alcoholic beverage daily. However, mortality from breast cancer among women was approximately 30% higher in women who reported consuming at least one drink daily, compared with non-drinkers (RR = 1.3, 95% CI; 1.1 to 1.6) (Thun et al., 1997).

3. Alcohol and Tobacco Use

Consistent with other studies, Launoy et al (1997) has reported that the greatest risk of developing esophageal cancer occurs with the use of approximately 70 grams of tobacco per week (or half a packet of cigarettes per day). Research suggests that the diets reported by smokers tend to put them at greater nutritional risk than non-smokers (Subar et al., 1990). However, with regard to consumption of alcohol, the higher the dose, the higher the estimated risk (Launoy et al., 1997). Evidence suggests that for a given lifetime consumption of tobacco, a moderate intake for a long period of time poses a greater risk than a high intake for a shorter duration (Launoy et al., 1997). Conversely, for a given lifetime consumption of alcohol, a high intake during a short period poses a greater risk than a moderate intake for a longer period (Launoy et al., 1997). Based on epidemiologic studies, alcoholic beverages have been classified as group 1 carcinogens (carcinogenic to humans) for cancers of the mouth and pharynx, larynx, esophagus and liver (IACR, 1997).

4. Canadians and Alcohol Consumption

Approximately 74% of Canadians reported drinking alcohol during the past 12 months in the 1993 General Social Survey (General Social Survey, 1993 Part I). Among the Canadian population aged 20 years and older it is estimated that 59% are current drinkers (Report on the Health of Canadians, 1996-based on persons who consume one or more drinks per month). Approximately 44% reported consuming less than one drink per week and 37% reported consuming between one and six drinks per week (Report on the Health of Canadians, 1996). Approximately 65% of Canadian men and 45% of Canadian women reported being current drinkers. Alcohol consumption is positively associated with educational attainment. Approximately 71% of university graduates reported drinking at least once a month compared to 47% of individuals who reported having completed secondary school (high school) (Report on the Health of Canadians, 1996).

The Alberta Alcohol and Drug Abuse Commission (AADAC) states that there is "no important physical health reason to consume alcohol and there is no level of consumption that is without risk". The AADAC defines moderate drinking for most adults as the consumption of no more than one alcoholic beverage a day and the consumption of no more than 7 alcoholic beverages during a week. More than four alcoholic beverages consumed on any occasion or more than 14 drinks for men and more than 9 drinks for women consumed in a week is considered a risk to health and safety. Between 1994-1995, approximately 5% of Alberta residents reported drinking daily (Report on the Health of Canadians, 1996). It is suggested that people who exceed two drinks a day or consume more than 3 or 4 drinks on any occasion should reduce their consumption of alcohol. The consumption of alcohol by Canadians by age and sex appears in Table 6.3.

Table 6.3 Alcohol Consumption Among Canadians by Age and Sex, 1995

	Total[1]	Regular Drinker	Occasional Drinker	Do Not Drink Now	Abstains
	Number of Canadians				
Males	11,780,335	7,669,137	1,710,410	1,198,696	1,171,034
Females	12,168,269	5,434,082	3,257,234	1,739,441	1,730,345
	Percent (%) Distribution				
12-19 years	100.0	27.9	26.1	12.1	33.9
Male	100.0	29.9	22.1	11.9	36.2
Female	100.0	25.7	30.6	12.4	31.3
20-29 years	100.0	64.3	20.6	8.5	6.5
Male	100.0	76.8	12.8	5.6	4.5
Female	100.0	52.0	28.3	11.3	8.4
30-44 years	100.0	64.3	20.0	9.0	6.7
Male	100.0	76.0	11.8	7.2	4.9
Female	100.0	52.7	28.1	10.7	8.5
45-64 years	100.0	59.8	18.5	12.9	8.5
Male	100.0	71.0	12.4	10.7	5.5
Female	100.0	48.6	24.6	15.2	11.5
65 years and over	100.0	39.8	21.2	23.2	15.4
Male	100.0	51.9	19.2	21.1	7.3
Female	100.0	30.7	22.7	24.9	21.5

[1] Values may not add to total because the category of drinker was not stated for some respondents.

Source: National Population Health Survey, 1996

Among Canadians, young adults, males and individuals that report higher income levels consume higher estimated intakes of alcohol compared with other Canadians (Table 6.4 & Table 6.5). In 1992 and 1993, the average Canadian aged 15 years or older spent approximately $462 on alcohol beverages each year (Single, 1997). The proportion of current consumers of alcohol reported in national surveys between 1978 and 1993 appears in Table 6.4. A summary of sociodemographic and socioeconomic variables associated with alcohol consumption among Canadians is reported in Table 6.5 and Table 6.6.

Table 6.4 Proportion of Current Drinkers in National Surveys Between 1978 and 1993

		Non-Drinkers		Current
Year	Survey	Never	Former[1]	Drinkers[2]
1978-1979	Canada Health Survey	11.5%	3.7%	84.0%
1985	Health Promotion Survey	7.7%	10.4%	81.4%
1985	General Social Survey	13.0%	6.0%	81.0%
1989	National Alcohol & Other Drugs	6.6%	15.7%	77.7%
1990	Health Promotion Survey	8.0%	11.0%	81.0%
1991	General Social Survey	9.0%	12.0%	79.0%
1993	General Social Survey	7.7%	18.0%	74.4%

1Former drinker is anyone who used to consume alcohol but has not used alcohol in the previous 12 months.

2 In the Canada Health Survey, Canada's Health Promotion Survey, and 1991General Social Survey, a current drinker is anyone who consumes alcoholic beverages at least once a month. In the National Alcohol & Other Drug Survey, and 1993 General Social Survey, a current drinker is anyone who consumed alcohol in the 12 months preceding the survey.

Source: 1993 General Social Survey I

Table 6.5 Reported Drinking Status, Drinking Level & Number of Heavy Drinking Occasions Among Current Drinkers by Various Sociodemographic Variables in 1993

	Drinking Status %			Level & Heavy Drinking Occasions, Among Current Drinkers			
Variable	Never	Former	Current Drinkers	Drinks/ week	% Any Heavy Occasions*	Mean # of Heavy Occasions †	Total Sample Size
Overall	7.7%	18.0%	74.4%	4.2	46.2%	15.7	10,385
Gender							
Male	4.8	14.6	80.6	5.9	58.0	19.4	4,789
Female	10.4	21.2	68.4	2.3	33.1	8.4	5,596
Age (years)							
18-19	9.0	12.5	78.6	5.0	76.9	17.2	300
20-24	6.0	9.4	84.6	5.2	68.8	19.2	805
25-34	5.5	12.2	82.3	4.3	57.4	14.5	2,500
35-44	4.6	15.0	80.4	3.7	46.5	15.2	2,222
45-54	7.4	16.9	75.6	4.5	36.3	16.2	1416
55-64	8.9	24.2	66.9	4.5	25.9	13.9	1,118
65-74	11.1	27.7	61.3	3.6	16.7	19.2	985
75 +	14.3	42.6	43.0	3.8	9.8	4.5	656
Marital Status							
Single	8.3	13.7	78.0	5.0	63.4	18.6	2,733
Married or Cohabitating	6.8	18.1	75.1	3.9	41.0	13.4	5,735
Divorced or Separated	5.9	18.1	76.1	4.6	43.5	18.1	924
Widowed	15.4	36.3	48.3	2.7	14.9	6.8	923
Income Adequacy							
Lowest	13.1	23.8	63.1	3.5	49.3	16.0	666
Lower Middle	10.5	22.2	67.3	3.9	39.1	20.8	941
Middle	7.5	20.6	72.0	4.0	44.1	16.7	2,317
Upper Middle	4.9	13.0	82.2	4.1	47.6	14.9	2,841
Highest	2.8	9.4	87.8	4.8	53.4	13.0	1,014
Education							
Completed University	5.2	13.7	81.1	4.0	44.1	12.7	3,753
Some Post Secondary	5.1	12.7	82.2	4.5	52.7	19.6	1,573
Secondary	7.3	16.8	75.9	4.0	49.1	14.0	1,617
Less Than Secondary	11.9	26.1	62.0	4.6	43.7	18.6	3,023

Table 6.6 Reported Drinking Status, Drinking Level & Number of Heavy Drinking Occasions Among Current Drinkers by Various Sociodemographic Variables in 1993

	Drinking Status %			Level & Heavy Drinking Occasions, Among Current Drinkers			
Variable	Never	Former	Current Drinkers	Drinks/ week	% Any Heavy Occasions*	Mean # of Heavy Occasions †	Total Sample Size
Employment Status							
Professional	3.8	8.6	87.5	3.5	40.3	9.5	738
Semi Professional	3.5	11.8	84.7	4.2	49.9	14.2	1,093
Supervisor	5.0	14.6	80.4	4.9	53.5	16.4	278
Skilled/Farmer	3.7	10.0	86.3	4.6	56.1	15.2	1,119
Semi Skilled	6.3	15.5	78.2	4.7	54.9	18.1	1,100
Unskilled	5.9	14.9	79.2	5.0	54.6	17.4	1,036
Other Working	4.8‡	19.4‡	75.8	3.9	44.0	21.4	75
Looking for Work	7.0	17.9	75.2	5.9	54.2	22.6	413
Student	11.7	16.3	71.9	3.8	63.1	13.4	1,020
Homemaker	14.4	25.8	59.8	2.2	22.8	10.3	1,537
Retired	8.9	31.2	60.0	4.2	17.8	16.4	1,382
Other	8.4	32.9	58.7	8.1	40.6	56.4	230
Community Size							
>1,000,000	8.8	18.8	72.4	4.3	43.0	15.1	2,467
<500,000 <1,000,000	6.0	14.8	79.2	4.1	46.8	17.5	1,781
<100,000 <500,000	7.3	17.7	75.0	4.2	47.0	13.5	1,815
<100,000	6.5	17.8	75.7	4.2	46.4	15.2	1,572
Rural	8.3	19.3	72.3	4.2	49.7	16.8	2,750

Source: General Social Survey, 1993.

* Percent of current drinkers reporting consumption of five or more drinks on at least one occasion in the previous year.

† Mean number of occasions in the previous year in which five or more drinks were consumed, among those reporting at least one occasion.

‡ Data should be interpreted with caution due to high sampling variability

II. RESULTS

A. Age and Sex

1. Effect of Age and Sex on Weekly Alcohol Intake

Alberta residents aged 18-74 years consumed approximately 4.2 drinks per week (data not shown). Males between 18-34 years consumed significantly ($p < 0.05$) more drinks per week than males between 50-74 years and females between 18-74 years (Table 6.7). Females between 18-34 years consumed significantly ($p < 0.05$) fewer drinks per week than females between 65-74 years (Table 6.7). The number of drinks consumed per week declined significantly ($p < 0.05$) with increasing age (Table 6.7).

Table 6.7 Weekly Alcohol Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Males 18-34	275	7^{a}	13	0	92.0
Males 35-49	262	$6^{a,b}$	8	0	43.0
Males 50-64	258	$6^{b,c}$	7	0	54.0
Males 65-74	180	4^{c}	6	0	91.0
Females 18-34	312	3^{d}	5	0	38.0
Females 35-49	290	$2^{d,e}$	4	0	25.5
Females 50-64	286	$2^{d,e}$	6	0	67.5
Females 65-74	176	1^{e}	3	0	22.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

2. Effect of Age and Sex on Weekly Beer Intake

The average number of beers consumed per week among Alberta residents was approximately 1.2 beers/week (data not shown). Males between 18-34 years and 35-49 years consumed significantly ($p < 0.05$) more beer per week than any other group (Table 6.8). Weekly beer intake decreased significantly ($p < 0.05$) with increasing age among males (Table 6.8). Females between 65-74 years consumed significantly ($p < 0.05$) less beer per week than any other group (Table 6.8).

Table 6.8 Weekly Beer Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Males 18-34	275	5^{a}	10	0	72.0
Males 35-49	262	3^{b}	6	0	42.0
Males 50-64	258	2^{c}	4	0	33.0
Males 65-74	180	1^{d}	2	0	12.0
Females 18-34	312	1^{d}	3	0	36.0
Females 35-49	290	$0.5^{c,d}$	1	0	10.0
Females 50-64	286	$0.8^{c,d}$	4	0	48.0
Females 65-74	176	0.1^{e}	0.2	0	4.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Effect of Age and Sex on Weekly Wine Intake

Alberta residents consumed 0.8 glasses of wine per week on average (data not shown). Males between 35-49 and 50-64 years consumed significantly ($p < 0.05$) more wine per week than males between 18-34 years (Table 6.9). Females between 35-49 years consumed significantly ($p < 0.05$) more wine per week than females between 18-34 years and 65-74 years (Table 6.9).

Table 6.9 Weekly Wine Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Males 18-34	275	$0.6^{a,b}$	2	0	12.0
Males 35-49	262	0.9^{c}	2	0	16.0
Males 50-64	258	1.4^{c}	2	0	14.0
Males 65-74	180	$1.0^{b,c}$	2	0	28.0
Females 18-34	312	$0.7^{a,b}$	2	0	14.2
Females 35-49	290	$1.0^{b,c}$	2	0	14.0
Females 50-64	286	$0.8^{a,b,c}$	1	0	14.0
Females 65-74	176	0.7^{a}	2	0	15.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

4. Effect of Age and Sex on Weekly Spirit Intake

Alberta residents consumed on average 1.6 spirits per week (data not shown). Males consumed significantly ($p < 0.05$) more spirits per week than females regardless of age (Table 6.10).

Table 6.10 Weekly Spirit Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Males 18-34	275	1.8^{a}	6	0	80.0
Males 35-49	262	1.9^{a}	5	0	42.0
Males 50-64	258	2.4^{a}	5	0	49.0
Males 65-74	180	2.4^{a}	5	0	91.0
Females 18-34	312	1.1^{b}	3	0	21.0
Females 35-49	290	0.8^{b}	2	0	14.0
Females 50-64	286	0.7^{b}	2	0	18.0
Females 65-74	176	0.8^{b}	2	0	21.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

5. Effect of Age and Sex on Alcohol Intake

The average alcohol intake among Alberta residents was 7.0 grams per day (data not shown). Males between 65-74 years consumed significantly ($p < 0.05$) less alcohol per day than males between 18-64 years (Table 6.11).

Table 6.11 Alcohol Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (grams)	Standard Deviation	Minimum (grams)	Maximum (grams)
Males 18-34	275	12.5 ^{a}	38	0	246.6
Males 35-49	262	9.0 ^{a,b}	22	0	184.2
Males 50-64	258	10.1 ^{b}	18	0	285.2
Males 65-74	180	5.3 ^{c}	9	0	71.7
Females 18-34	312	4.8 ^{c,d}	18	0	135.3
Females 35-49	290	3.6 ^{c,d}	12	0	107.1
Females 50-64	286	2.9 ^{c,d}	7	0	46.4
Females 65-74	176	2.3 ^{d}	5	0	41.5

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

6. Effect of Age and Sex on Percent Energy From Alcohol

Significantly ($p < 0.0005$) more males than females consumed disproportionately more energy from alcohol (data not shown). Approximately 4.5% (N = 44 of 975) of males consumed more than 5% of their total energy intake as alcohol (> 2 drinks per day) (data not shown). Approximately 1.6% of females (N = 17 of 1064) consumed more than 2.5% of their total energy intake as alcohol (> 1 drink per day) (data not shown).

Table 6.12 Percent Energy From Alcohol by Age & Sex (un-weighed sample)

Age & Sex	18-34 Males	35-49 Males	50-64 Males	65-74 Males	18-34 Females	35-49 Females	50-64 Females	65-74 Females
Total Population	275	262	258	180	312	290	286	176
Alcohol Above Cutoff	2.9%	5.3%	5.4%	4.4%	0.6%	1.7%	1.4%	3.4%
Sample Size N	8	14	14	8	2	5	4	6

B. Marital Status

1. Effect of Marital Status on Weekly Alcohol Intake

The average number of drinks consumed by males was approximately 6.5 drinks/week (data not shown). Married males consumed significantly ($p = 0.0007$) fewer drinks per week than single males and males who reported being separated, divorced or widowed (Table 6.13). The weekly alcohol intake among females appears in (Appendix A Table 110).

Table 6.13 Weekly Alcohol Intake by Marital Status—Males (weighed sample)

Marital Status	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Single	176	7.3^{a}	12	0	92.0
Married	693	5.3^{b}	7	0	91.0
Separated, divorced & widowed	103	11.0^{a}	14	0	90.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

2. Effect of Marital Status on Weekly Beer Intake

Married males consumed significantly ($p = 0.0001$) fewer beers per week compared to single males and males who reported being separated, divorced or widowed (Table 6.14). Married females consumed significantly ($p = 0.0149$) less beer per week than single females (Table 6.15).

Table 6.14 Weekly Beer Intake by Marital Status—Males (weighed sample)

Marital Status	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Single	176	4.8^{a}	10	0	72.0
Married	693	2.4^{b}	4	0	42.0
Separated, divorced & widowed	103	6.5^{a}	10	0	36.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.15 Weekly Beer Intake by Marital Status—Females (weighed sample)

Marital Status	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Single	173	1.1^{a}	3	0	36.0
Married	671	0.5^{b}	2	0	23.0
Separated, divorced & widowed	218	$1.0^{a,b}$	4	0	48.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Effect of Marital Status on Weekly Spirit Intake

Single females consumed significantly ($p = 0.0035$) more alcohol from spirits per week than married, separated, divorced or widowed females (Table 6.16). There was no significant ($p > 0.05$) effect of marital status on the weekly spirit intake among males in the Alberta population (Appendix A Table 127).

Table 6.16 Weekly Spirit Intake by Marital Status—Females (weighed sample)

Marital Status	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Single	173	1.6^{a}	4	0	21.0
Married	671	0.6^{b}	2	0	21.0
Separated, divorced & widowed	218	0.8^{b}	2	0	18.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

C. Income

1. Effect of Income on Weekly Alcohol Intake

Males who reported income levels of less than $10,000-$19,999 consumed significantly ($p < 0.05$) fewer drinks per week than males who reported higher income levels (Table 6.17). There was no significant ($p > 0.05$) effect of reported income level on the weekly alcohol intake among females in the Alberta population (Appendix A Table 111).

Table 6.17 Weekly Alcohol Intake by Income—Males (weighed sample)

Income	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
<$10,000-$19,999	146	3.5^{a}	6	0	34.0
$20,000-$29,999	107	6.4^{b}	10	0	92.0
$30,000-$39,999	138	6.6^{b}	9	0	90.0
$40,000-$49,999	94	8.4^{b}	8	0	35.5
$50,000-$59,999	96	7.6^{b}	10	0	54.0
$60,000 +	304	6.6^{b}	9	0	54.5
Do not know & refused	87	5.5^{b}	11	0	72.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

2. Effect of Income on Weekly Wine Intake

Males who reported income levels between $40,000-49,999 and $60,000 or greater consumed significantly ($p < 0.05$) more wine per week than males who reported income levels of less than $10,000-29,999 (Table 6.18). Females who reported income levels of less than $10,000-29,999 consumed significantly ($p < 0.05$) less wine per week than females who reported income levels of $40,000 or greater (Table 6.19) (Table 6.18 & 6.19 appear at end of chapter 6).

3. Effect of Income on Weekly Spirit Intake

Weekly spirit consumption was significantly ($p < 0.05$) higher among males who reported income levels between $20,000-29,999 (Table 6.20). There was no significant ($p > 0.05$) effect of reported income level on the weekly spirit intake among females in the Alberta population (Appendix A Table 128).

Table 6.20 Weekly Spirit Intake by Income—Males (weighed sample)

Income	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
<$10,000-$19,999	146	1.1^{a}	3	0	21.0
$20,000-$29,999	107	3.5^{b}	9	0	91.0
$30,000-$39,999	138	2.6^{a}	6	0	54.0
$40,000-$49,999	94	2.4^{a}	5	0	28.0
$50,000-$59,999	96	2.1^{a}	5	0	49.0
$60,000 +	304	1.8^{a}	4	0	28.0
Do not know & refused	87	1.3^{a}	3	0	24.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

4. Effect of Income on Alcohol Intake

Males who reported household income levels of less than $10,000-19,999 consumed significantly ($p < 0.05$) less alcohol per day than males who reported higher income levels (Table 6.21). There was no significant ($p > 0.05$) effect of reported income level on the mean daily alcohol intake among females in the Alberta population (Appendix A Table 134).

Table 6.21 Alcohol Intake by Income—Males (weighed sample)

Income	Sample Size (N)	Mean (grams)	Standard Deviation	Minimum (grams)	Maximum (grams)
<$10,000-$19,999	146	3.8^{a}	12.2	0	113.3
$20,000-$29,999	107	13.0^{b}	27.1	0	285.2
$30,000-$39,999	138	$9.4^{a,b}$	19.5	0	100.5
$40,000-$49,999	94	14.3^{b}	26.8	0	158.4
$50,000-$59,999	96	13.6^{b}	35.9	0	210.9
$60,000 +	304	$9.5^{a,b}$	21.5	0	151.8
Do not know & refused	87	13.8^{b}	38.7	0	246.6

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

D. Employment

1. Effect of Employment on Weekly Alcohol Intake

Males who reported full-time employment consumed significantly (p = 0.0013) more drinks per week than males who reported part-time employment (self-employment or retirement) status and unemployment (homemaker or student) status (Table 6.22). Females who reported full-time employment consumed significantly (p = 0.0119) more drinks per week than females who reported part-time employment (self-employment or retirement) status (Table 6.23) (Table 6.22 & 6.23 appears at end of chapter 6).

2. Effect of Employment on Weekly Beer Intake

Males who reported part-time employment (self-employment or retirement) status consumed significantly (p = 0.0001) less beer per week than males who reported full-time employment or unemployment (homemaker or student) status (Table 6.24 appears at end of chapter 6). There was no significant (p > 0.05) effect of employment on the weekly beer intake among females in the Alberta population (Appendix A Table 118).

E. Smoking

1. Weekly Alcohol Intake in Smokers and Non-Smokers

Male and female smokers consumed significantly (p = 0.0001) more drinks per week than non-smokers (Table 6.25 and 6.26).

Table 6.25 Weekly Alcohol Intake by Smoking Status—Males (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non-smokers	743	5.8^{a}	8	0	92.0
Smokers	229	8.2^{b}	12	0	91.0

For the column, mean intake, means that do not share a common superscript are significantly different (p < 0.05).

Table 6.26 Weekly Alcohol Intake by Smoking Status—Females (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non-smokers	807	2.0^{a}	4	0	67.5
Smokers	256	3.8^{b}	5	0	38.0

For the column, mean intake, means that do not share a common superscript are significantly different (p < 0.05).

2. Weekly Beer Intake in Smokers and Non-Smokers

Male and female smokers consumed significantly ($p = 0.0001$) more beer per week than non-smokers (Table 6.27 & 6.28).

Table 6.27 Weekly Beer Intake by Smoking Status—Males (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non—smokers	743	2.9^{a}	5	0	42.0
Smokers	229	5.0^{b}	10	0	72.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.28 Weekly Beer Intake by Smoking Status—Females (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non—smokers	807	0.5^{a}	2	0	48.0
Smokers	256	1.4^{b}	3	0	36.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Weekly Spirit Intake in Smokers and Non-Smokers

Male and female smokers consumed significantly ($p = 0.0003$) ($p = 0.0002$) more alcohol as spirits per week than non-smokers (Table 6.29 & 6.30).

Table 6.29 Weekly Spirit Intake by Smoking Status—Males (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non—smokers	743	1.8^{a}	5	0	80.0
Smokers	229	2.6^{b}	7	0	91.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.30 Weekly Spirit Intake by Smoking Status—Females (weighed sample)

Smoking	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Non—smokers	807	0.7^{a}	2	0	21.0
Smokers	256	1.6^{b}	3	0	21.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

4. Alcohol Intake in Smokers and Non-Smokers

Male and female smokers consumed significantly ($p = 0.0003$) ($p = 0.0002$) more alcohol per day on average than non-smokers (Table 6.31 & Table 6.32).

Table 6.31 Alcohol Intake by Smoking Status—Males (weighed sample)

Smoking	Sample Size (N)	Mean (grams)	Standard Deviation	Minimum (grams)	Maximum (grams)
Non-smokers	743	9.0 ^{a}	19.3	0	158.4
Smokers	229	14.8 ^{b}	38.6	0	285.2

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.32 Alcohol Intake by Smoking Status—Females (weighed sample)

Smoking	Sample Size (N)	Mean (grams)	Standard Deviation	Minimum (grams)	Maximum (grams)
Non-smokers	807	2.8 ^{a}	8.6	0	107.1
Smokers	256	7.4 ^{b}	19.1	0	135.3

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

F. Other Factors and their Relationship to Alcohol Consumption

There was no significant ($p > 0.05$) effect of marital status or employment on the average daily alcohol intake or the weekly wine intake among males and or females in the Alberta population (Appendix A Tables 119 & 120, 123 & 124, 133 & 137 & 138). There was no significant ($p > 0.05$) effect of reported income level on the weekly beer intake, no significant ($p > 0.05$) effect of employment on the weekly spirit intake, weekly beer intake or weekly wine intake, and no significant ($p > 0.05$) effect of smoking on the weekly wine intake among males and or females in the Alberta population (Appendix A Tables 114 & 115 & 118, 125 & 126, 131 & 132). There was no significant ($p > 0.05$) effect of educational attainment on the weekly alcohol, beer, wine and spirit intake or average daily alcohol intake among males and or females in the Alberta population (Appendix A Tables 112 & 113, 116 & 117, 121& 122, 129 & 130, 135 & 136). There was no significant ($p > 0.05$) effect of marital status, reported household income level, educational attainment, employment status or smoking on the average percent energy consumed from alcohol among males and females in the Alberta population (data not shown). However, the proportion of male and female non-smokers that reported consuming alcohol in Alberta was approximately 59.5% and 40.5%; respectively (data not shown). The proportion of male and female smokers that reported consuming alcohol in the Alberta population was approximately 60.3% and 39.7%; respectively (data not shown).

G. Proportion of the Population Classified as Heavy Drinkers

Approximately 14.2% of Alberta males consumed more than 14 drinks per week and approximately 5.5% of Alberta females consumed more than 9 drinks per week (Table 6.33).

Table 6.33 Social Distribution of Heavy Drinking by Age & Sex (un-weighed sample)

Alcohol Consumers	18-34 years	35-49 years	50-64 years	65-74 years
Sample Size (females)	290	266	269	164
Distribution of heavy alcohol consumers	21	13	14	6
Percent distribution of females that consume over 9 drinks per week	7.2%	4.9%	5.2%	3.7%
Sample Size (males)	251	244	247	164
Distribution of heavy alcohol consumers	41	36	38	14
Percent distribution of males that consume over14 drinks per week	16.3%	14.7%	15.4%	8.5%

H. Alcohol Consumption by Smokers

Among females that reported smoking cigarettes approximately 30% reported that they do not consume alcohol, 60% reported consuming 9 drinks per week or less and 10% reported consuming more than 9 drinks per week (Table 6.34). Among males that reported smoking cigarettes approximately 21% reported that they do not drink alcohol, 56% reported consuming 14 drinks per week or less and 22% reported consuming more than 14 drinks per week (Table 6.34).

Table 6.34 Alcohol Consumption and Smoking (un-weighed sample)

Smokers Only	Sample Size (N)	Mean number of cigarettes	Median	Standard Deviation	Maximum
Female alcohol abstains	87	17[a]	15	8	50
Females that consume 9 drinks or less per week	172	15[a]	14	8	40
Females that consume more than 9 drinks per week	28	16[a]	14	9	45
Male alcohol abstains	55	21[a]	20	12	60
Males that consume 14 drinks or less per week	145	16[a]	18	11	50
Males that consume more than 14 drinks per week	57	17[a]	25	9	50

[a] The mean number of cigarettes smoked are not significantly different.

I. Key Micronutrients Affected by Alcohol Consumption

1. Effect of Age and Sex on Dietary Folate Intake

The proportion of individuals not meeting their respective recommended nutrient intake for folate from dietary sources ranged from 52% of males between 35-49 years to approximately 68% of males between 65-74 years (Table 6.35). The mean estimated dietary folate intake decreased significantly ($p < 0.05$) with increasing age among males (Table 6.35). Females consumed significantly ($p < 0.05$) less dietary folate than males of similar ages, particularly females of child bearing age (18-45 years) (Table 6.35 appears at end of chapter 6).

2. Effect of Age and Sex on Dietary Thiamin Intake

The proportion of individuals not meeting their respective recommended nutrient intake for thiamin from dietary sources ranged from 21% of males between 18-34 years to approximately 54% of females between 35-49 years (Table 6.36). The estimated intake of thiamin from dietary sources was significantly ($p < 0.05$) lower among males and females aged 18-49 years on average compared to males and females between 50-74 years (Table 6.36 appears at end of chapter 6).

3. Effect of Age and Sex on Dietary Riboflavin Intake

The proportion of individuals not meeting their respective recommended nutrient intake for riboflavin from dietary sources ranged from 16% of males between 18-34 years to approximately 60% of females between 50-64 years (Table 6.37). The mean estimated riboflavin intake was significantly ($p < 0.05$) lower among males between 35-49 years and 65-74 years compared to females between 65-74 years (Table 6.37 appears at end of chapter 6).

III. SUMMARY OF ESTIMATED ALCOHOL INTAKE

Several socio-demographic and socio-economic factors were associated with alcohol consumption including age and sex, marital status, reported household income level, employment status, and smoking. Males and females between 18-34 years consumed significantly ($p < 0.05$) more drinks per week on average than males and females between 65-74 years. Males between 18-34 years consumed significantly ($p < 0.05$) more beer per week than other groups. However, males between 35-64 years and females between 35-49 years consumed significantly ($p < 0.05$) more wine per week than males and females between 18-34 years and females between 65-74 years. Males consumed significantly ($p < 0.05$) more alcohol from spirits per week on average than females and did not vary by age. Approximately 14.2% of males and 5.5% of females in Alberta were classified as heavy drinkers.

Married males consumed significantly ($p < 0.05$) fewer drinks per week, and significantly ($p < 0.05$) less beer per week on average than single, separated, divorced and widowed males. Single females consumed significantly ($p < 0.05$) more alcohol from spirits per week than married, separated, divorced and widowed females. Single females consumed significantly ($p < 0.05$) more beer per week on average than married females.

Males who reported household income levels of less than $10,000-19,999 consumed significantly ($p < 0.05$) fewer drinks per week on average than males who reported higher income levels. Males who reported household income levels between $40,000-49,999 and $60,000 or greater consumed significantly ($p < 0.05$) more wine per week on average than males who reported income levels of less than $10,000-29,999. However, males who reported household income levels between $20,000-29,999 consumed significantly ($p < 0.05$) more alcohol from spirits per week than males who reported other income levels. Similarly, females who reported household income levels between $40,000-60,000 or greater consumed significantly ($p < 0.05$) more wine per week on average than females who reported income levels of less than $10,000-29,999.

Males and females who reported full-time employment consumed significantly ($p < 0.05$) more drinks per week on average than males and females who reported part-time employment (self-employment or retirement) status. Males who reported full-time employment and unemployment (homemaker or student) status consumed significantly ($p < 0.05$) more beer per week on average than males who reported part-time employment (self-employment or retirement) status.

Males and females who reported smoking consumed significantly ($p < 0.05$) more drinks, beer and alcohol from spirits per week on average than non-smokers. This resulted in males and females who reported smoking consuming significantly ($p < 0.05$) more alcohol per day on average than non-smokers. There was no significant ($p > 0.05$) effect of smoking on the average number of drinks of wine consumed per week.

IV. SUMMARY OF ALCOHOL CONSUMPTION AND TOBACCO USE

Among male smokers, approximately 21% reported consuming no alcohol (within 1 month of participating in the survey), 56% reported consuming 14 drinks or less per week and 22% reported consuming more than 14 drinks per week. Among female smokers, approximately 30% reported consuming no alcohol (within 1 month of participating in the survey), 60% reported consuming 9 drinks or less per week and 10% reported consuming more than 9 drinks per week.

V. SUMMARY OF SELECT B VITAMINS AFFECTED BY ALCOHOL INTAKE

There were main findings of low intakes of B vitamins obtained from dietary sources by age and sex. Approximately 56% of males and 61% of females did not meet their respective RNI for folate from dietary sources. Males between 18-34 years consumed significantly ($p < 0.05$) higher intakes of folate from dietary sources on average than males between 35-74 years. Females between 50-74 years consumed average dietary folate intakes that fell below the recommended nutrient intake. Approximately 28% of males and 52% of females did not meet their respective RNI for thiamin from dietary sources. Males and females between 18-49 years consumed significantly ($p < 0.05$) lower intakes of thiamin on average than males and females between 50-74 years. Approximately 27% of males and 51% of females did not meet their respective RNI for riboflavin from dietary sources.

VI. DISCUSSION

Overall, Alberta residents consumed approximately 4.2 drinks per week on average. The number of drinks residents consumed in the ANS is consistent with the number of drinks reported in the 1993 General Social Survey. Alberta males consumed 6.5 drinks per week and females consumed approximately 2.2 drinks per week on average. In the General Social Survey (1993) males consumed approximately 5.9 drinks per week and females consumed 2.3 drinks per week; respectively. In the ANS, males and females aged 65-74 years consumed significantly ($p < 0.05$) fewer drinks per week than males and females between 18-34 years. Senauer et al (1991) reported that less than average amounts of alcohol are consumed by individuals 65 years and older.

In the ANS, alcohol abstains are defined as those individuals who did not report consuming alcohol within one month prior to completing the survey. Therefore, the number of individuals who completely abstain from alcohol is not truly reflected in this survey. In the ANS, approximately 60% of males and 40% of females reported consuming alcohol. Between 1996 and 1997, approximately 63% of men and 43% of women in Canada reported consuming alcohol at least once per month (National Population Health Survey, 1997).

Several sociodemographic and socioeconomic characteristics are associated with alcohol consumption rates and patterns (Single et al., 1995). In the ANS, males and females between 18-34 years consumed more drinks per week than males and females between 65-74 years and single males consumed more drinks per week than married males. Males and females that reported full-time employment consumed more drinks per week than residents who reported part-time employment (self-employment or retirement) status, and males and females that reported smoking consumed more drinks per week than non-smokers. Results from the ANS regarding alcohol consumption are consistent with what has been previously reported in the General Social Survey (1993).

In addition, several sociodemographic and socioeconomic factors influenced whether Alberta residents consumed beer, wine or spirits. Residents that consumed more beer per week included males between 18-34 years, single males and females, males who reported full-time employment, and males and females that reported smoking. Residents that consumed more wine per week included males between 35-64 years and females between 35-49 years and males and females that reported higher income levels ($40,000 or greater). Males, single females, males that reported low income levels ($20,000-29,999), and males and females that reported smoking consumed significantly ($p < 0.05$) more alcohol from spirits. How these factors influence the type of alcohol consumed remains unclear. In a recent Danish study, Grønbaek et al (1995) reported a significant and progressive reduction in risk of coronary heart disease with increased consumption of wine, and an *increased* risk of coronary heart disease with higher intakes of alcohol from spirits, and no effect of beer. In a comparative study of diet, alcohol consumption and risk of coronary heart disease and cancer, countries that consumed more wine also consumed more meat, cheese, polyunsaturated fat and foods higher in antioxidants, such as fresh fruit and vegetables (Bellizzi et al., 1994). Whereas, countries that consumed more beer ate more potatoes and saturated fat (Bellizzi et al., 1994). Factors other than the amount and type of alcohol consumed, such as higher socioeconomic status among wine drinkers and lower socioeconomic status among individuals that consume spirits, may confound the association between risk of coronary heart disease and certain types of cancer and alcohol consumption. In the ANS, males and females that reported smoking consumed higher amounts of beer and spirits than non-smokers, but similar amounts of wine. Smoking is a well accepted risk factor for coronary heart disease (Ockeen et al., 1990) and cancer (Diana, 1993).

There are a variety of different ways to estimate alcohol consumption. In the Alberta Nutrition Survey respondents' weekly alcohol intake was estimated using a semi-quantitative food frequency questionnaire. One of the limitations of the ANS, when looking at estimated alcohol intake and dietary risk factors for cancer, is that it is unknown whether respondents who consumed alcohol, consumed alcohol spread over more days of the week or limited their consumption to only one or two days. One study showed that when alcohol intake is limited to 7 to 14 drinks a week, spreading consumption over seven days instead of six lowers the risk of some problems, including alcohol dependence (Walsh and Rehm, 1996). In 1990, 20% (332,300) of Alberta residents reported consuming seven or more alcoholic beverages per week, and 4% reported consuming twenty drinks per week or more (Alberta Heart Health Survey, 1990). In the ANS, reported alcohol consumption would classify approximately 14.2% of males and 5.5% of females as heavy drinkers, which is defined as more than 14 drinks per week for men and more than 9 drinks per week for women. In the National Population Health Survey (1997) men and women that reported higher income levels were more likely to be classified as heavy drinkers.

Another limitation of the ANS is that it is unknown whether drinkers added alcohol to their normal diets or if they substituted alcohol for part of their diet. Alcohol consumption adversely affects micronutrient and macronutrient status through a variety of mechanisms, especially nutrients associated with energy metabolism, such as folate, thiamin and riboflavin. Research suggests that consumption of alcohol interferes with several aspects of nutrition, including the intake, absorption, storage, activation, utilization and excretion of several micronutrients (Basu and Dickerson, 1996), thereby possibly increasing the requirement for some micronutrients. In the ANS over 50% of residents did not meet their respective RNI for folate from dietary sources. In addition, many Alberta residents did not meet their recommended nutrient intakes for thiamin and riboflavin. Heavy drinkers are most susceptible to B vitamin deficiencies (Basu and Dickerson, 1996). Further analysis will be conducted to identify sub-populations that are more likely to consume low intakes of micronutrients and the socioeconomic factors that may contribute to sub-optimal nutrition in the Alberta population.

Overall, several sociodemographic and socioeconomic factors were associated with the amount and type of alcohol consumed by Alberta residents and the number of individuals classified as heavy drinkers. Males and females between 18-34 years, residents employed full-time and smokers consumed higher amounts of alcohol. Younger residents and smokers were more likely to consume beer, whereas older residents and residents that reported higher income levels were more likely to consume wine. Males who reported low income levels and smokers were more likely to consume spirits. Further analysis will be conducted to determine the association between alcohol consumption as it relates to the American Cancer Society's recommendations regarding macro and micronutrient intake and body mass index.

Table 6.18 Weekly Wine Intake by Income—Males (weighed sample)

Income	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
<$10,000-$19,999	146	0.3^{a}	1	0	4.0
$20,000-$29,999	107	$0.5^{a,b}$	1	0	7.0
$30,000-$39,999	138	$0.8^{b,c}$	2	0	14.0
$40,000-$49,999	94	1.3^{c}	2	0	14.0
$50,000-$59,999	96	$1.0^{b,c}$	2	0	14.0
$60,000 +	304	1.1^{c}	3	0	16.0
Do not know & refused	87	$0.7^{b,c}$	3	0	28.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.19 Weekly Wine Intake by Income—Females (weighed sample)

Income	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
<$10,000-$19,999	192	0.3^{a}	1	0	14.2
$20,000-$29,999	127	0.6^{a}	1	0	4.0
$30,000-$39,999	135	$0.7^{a,b}$	2	0	14.0
$40,000-$49,999	117	$0.9^{b,c}$	2	0	14.0
$50,000-$59,999	102	$0.8^{b,c}$	1	0	14.0
$60,000 +	231	1.3^{c}	2	0	15.0
Do not know & refused	158	0.5^{a}	1	0	10.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.22 Weekly Alcohol Intake by Employment Status—Males (weighed sample)

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	472	7.4^{a}	11	0	92.0
Part-time, Self-employed & Retired	413	5.2^{b}	7	0	91.0
Unemployed, Homemaker & Student	87	4.6^{b}	10	0	36.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.23 Weekly Alcohol Intake by Employment Status—Females (weighed sample)

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	357	2.4^{a}	4	0	38.0
Part-time, Self-employed & Retired	425	2.1^{b}	4	0	25.5
Unemployed, Homemaker & Student	281	$2.7^{a,b}$	6	0	67.5

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.24 Weekly Beer Intake by Employment Status—Males (weighed sample)

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	472	4.3^{a}	8	0	72.0
Part-time, Self-employed & Retired	413	2.0^{b}	3	0	33.0
Unemployed, Homemaker & Student	87	3.3^{a}	8	0	30.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.35 Dietary Folate Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Proportion Not Meeting RNI for Folate (%)	Mean (µg)	Standard Deviation	Median (µg)	Minimum (µg)	Maximum (µg)
Males 18-34	275	54.9%	315.0^{a}	247	261.2	59.5	1059.1
Males 35-49	262	52.3%	253.6^{b}	185.1	231.2	22.9	1361.3
Males 50-64	258	54.3%	244.7^{b}	106.2	221.2	27.5	1176.0
Males 65-74	180	67.8%	201.6^{c}	64.8	193.7	6.4	611.3
Females 18-34	312	63.1%	196.6^{d}	122.5	163.5	21.2	984.6
Females 35-49	290	59.0%	$201.3^{c,d}$	115.2	169.9	26.0	779.8
Females 50-64	286	59.4%	$200.9^{c,d}$	102.0	178.3	52.7	1040.5
Females 65-74	176	62.5%	186.4^{d}	72.7	168.5	45.2	712.8

Note: proportion not meeting RNI for folate from dietary sources is based on un-weighed data (chi-square $p < 0.012$)
For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.36 Dietary Thiamin Intake (per 1000 kilo-calories) by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Proportion Not Meeting RNI for Thiamin (%)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)
Males 18-34	275	21.4%	0.69 ^{a}	0.36	0.62	0.18	4.2
Males 35-49	262	27.9%	0.69 ^{a}	0.34	0.60	0.10	2.6
Males 50-64	258	30.2%	0.75 ^{b}	0.27	0.67	0.14	2.2
Males 65-74	180	32.8%	0.76 ^{b}	0.23	0.70	0.14	2.1
Females 18-34	312	50.3%	0.72 ^{a}	0.36	0.64	0.06	2.1
Females 35-49	290	54.5%	0.69 ^{a}	0.29	0.63	0.13	2.3
Females 50-64	286	53.1%	0.78 ^{b}	0.28	0.70	0.25	2.0
Females 65-74	176	49.3%	0.80 ^{b}	0.24	0.73	0.26	1.9

Note: proportion not meeting RNI for thiamin from dietary sources is based on un-weighed data
For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

Table 6.37 Dietary Riboflavin Intake (per 1000 kilo-calories) by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Proportion Not Meeting RNI for Riboflavin (%)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)
Males 18-34	275	16.4%	0.87 ^{a,b}	0.35	0.83	0.32	2.85
Males 35-49	262	25.6%	0.84 ^{a}	0.30	0.80	0.35	1.64
Males 50-64	258	30.6%	0.87 ^{a,b}	0.26	0.81	0.31	3.57
Males 65-74	180	38.9%	0.87 ^{a}	0.32	0.80	0.17	3.57
Females 18-34	312	43.3%	0.88 ^{a,b}	0.31	0.81	0.24	2.53
Females 35-49	290	49.7%	0.85 ^{a,b}	0.27	0.81	0.24	1.79
Females 50-64	286	60.5%	0.88 ^{a,b}	0.30	0.82	0.38	7.20
Females 65-74	176	54.0%	0.93 ^{b}	0.20	0.87	0.28	1.88

Note: proportion not meeting RNI for riboflavin from dietary sources is based on un-weighed data
For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

VII.LITERATURE CITED

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CHAPTER SEVEN

I. INTRODUCTION

A. TOTAL ENERGY INTAKE

The American Cancer Society (1996) recommends adjusting physical activity and food intake to attain and maintain a healthy body weight.

a) Literature Review

Several studies associating body weight and adverse health effects assume a curvilinear relationship, often producing a J shaped curve, whereby underweight is associated with health problems for some people and overweight is associated with even greater health impairment compared to individuals of moderate weight. (Bray, 1985; White, 1985). In lieu of more precise determinations of body composition simple, convenient anthropometric measurements are most often used as approximations of body fat. Body weight is a continuous variable in large populations and therefore levels of risk are arbitrarily assigned (Health Implications of Obesity, 1985) and different studies often employ different methodologies (clinical measurements vs self reported height and weight). However it is not necessarily indicative of excess body fat as overly muscular individuals may have a higher BMI without presenting with adverse health problems (Health and Welfare Canada, 1988). Moreover, it should be noted that applying BMI values to individuals over 65 years of age provides a weaker association between increasing BMI and increasing risk of health problems. Therefore, it is not recommended for use to assess health risk in Canadians over the age of 65 years (Health and Welfare Canada, 1988). Nonetheless, reporting BMI values can be a useful measure for determining trends across age and sex groups.

Obesity has been associated with a number of comorbidities including (most commonly) Diabetes Mellitus (Felber et al., 1993; Pi-Sunyer, 1993), hypertension (Manson et al., 1990) and cardiovascular disease (Manson and Colditz, 1990). Evidence suggests that obesity is also associated with osteoarthritis (Hart and Spector, 1993; Hartz and Fischer, 1986), gallbladder disease (Maclure et al., 1989) and certain types of cancer including colorectal and prostate cancer in men and breast, cervical, gallbladder, endometrial and ovarian cancer in women (Kissebah and Freedman, 1989; Garfinkel, 1985). The Canadian Guidelines for Healthy Weights appear in Table 7.1.

Table 7.1 The Canadian Guidelines for Healthy Weights

BMI less than 20	May be associated with health problems for some people
BMI between 20 and 25	Good weight for most people
BMI between 25 and 27	May lead to health problems in some people
BMI greater than 27	Increasing risk of developing health problems

Health and Welfare Canada, 1988

Due to its inherently complicated nature obesity may therefore represent a proxy for other health related risk factors. Risk factors include excess energy intake, diets high in fat (independent of energy) and fat composition (Reddy, 1993). Inadequate physical activity may also further complicate the role of obesity as a possible risk factor implicated in the development of particular malignancies.

b) Obesity and Association with Cancer

In 1913, Hoffmann first suggested that diet marked with caloric excess was a factor in the etiology of cancer (Hoffman, 1913). Since then several possible mechanisms associating obesity with cancer have been proposed (Bal et al., 1988). Adipose tissue primarily functions as an energy reserve, storing fat for mobilization in response to metabolic demands (Health Implications of Obesity, 1985). Obesity may therefore be defined as an excess of adipose tissue frequently resulting in significant health impairment (Health Implications of Obesity, 1985). However, controversy continues to exist regarding the interpretation of data indicating an association between body weight and increased morbidity and mortality rates (Health Implications of Obesity, 1985). Studies designed to investigate the cancer-obesity relationship are difficult to interpret due to inconsistencies in data collection methods, the inability to control for genetic predisposition towards being overweight or developing cancer, and a milieu of environmental (and social) factors such as caloric intake, dietary composition, physical activity, metabolism, endocrine abnormalities, smoking habit and socioeconomic status.

The American Cancer Society Study (1959) was the first large prospective study to determine the relation between body fat and mortality. For the cohort of 336,422 men and 419,060 women for whom both height and weight measurements were collected, odds ratios were determined for the 5 major causes of death. According to the Quatelet index [weight (kg)/height (m)^2], attendant mortality from cancer (all sites) in subjects classified as overweight was lower than for any of the other major disease categories. Underweight men (weight index < 80% Ideal Body Weight) had one-third higher mortality ratios than men considered to be in the optimal mortality weight index (90-109% IBW). For women the less than 80% IBW index category was associated with 4% fewer mortalities relative to persons of average weight. The largest mortality indices recorded were for women with cancer of the endometrium. For women within the 130-139% IBW and 140% IBW index categories, odds ratios were 2.30 and 5.42; respectively. People of lower socioeconomic status and various ethnic groups were underrepresented (Garfinkel, 1985).

It is no longer acceptable to regard obesity as the result of an imbalance between energy intake and energy expenditure (Health Implications of Obesity 1985). Obesity is the result of multiple etiologic factors and there are different types of obesity (Health Implications of Obesity, 1985). Waist-Hip Ratios (WHR) are used to determine the distribution of fat patterns associated with abdominal obesity (Health and Welfare Canada, 1988). Alternatively, measures of waist circumference have been positively correlated with adverse health outcomes, including cancer (Huang et al., 1999). More recently, the protein leptin which is encoded by the ob gene, has been discovered to play a role in regulating energy balance and deposition of adipose tissue in rodent models (Considine et al., 1996; Meinders et al., 1996). Although this suggests a role in human obesity, identification of the ob/ob gene in humans is controversial (Meinders et al., 1996).

c) Caloric Restriction

Since Moreschi (1909) first reported successive caloric restriction progressively slowed tumor growth in animal models transplanted with sarcoma 7, many studies have provided evidence of a positive effect of energy in increasing the risk of developing cancer (Lyon et al., 1987; Howe et al., 1990). However, it is now fundamentally understood that the energy obtained from carbohydrates, fat and protein (4 kcal/g, 9 kcal/g and 4 kcal/g;

respectively), differ inherently in terms of their availability (digestibility) and metabolism (Morey, 1936; Atwater, 1900; Maynard, 1944), and as a result energy is no longer thought of as a homogenous nutrient. Therefore, studies investigating the relation between carcinogenesis and energy have further distinguished the source of dietary energy. In an overview of the evidence provided by experimental models and epidemiological studies there is data to suggest that diets high in fat (meat, saturated fat, and cholesterol) are positively associated with increased cancer mortality (Willett and MacMahon, 1985). Whereas consumption of diets proportionately higher in dietary fiber, fruit and vegetables, and antioxidants such as vitamin A, vitamin C, vitamin E and carotenes appear to be inversely related to cancer mortality (Miller et al., 1994; Helzlsouer et al., 1994). Nonetheless, it does appear that different stages of carcinogenesis can be influenced with dietary manipulation resulting in either an enhancing or suppressing effect on tumorigenesis (Welsch, 1994).

d) Exercise and Carcinogenesis

Several animal (Baracos, 1989) and epidemiological studies (Albanes et al., 1989) have also been conducted to investigate the role of exercise in cancer prevention. Determining the effects habitual physical activity has on reducing the risk of developing cancer becomes more difficult to measure in human populations. Studies that attempt to quantify occupational and leisure time activity are difficult to interpret because confounds such as socioeconomic status are difficult to control for (Shephard et al., 1995). Individuals with lower socioeconomic status may be exposed to more environmental carcinogens and may have more physically demanding occupations (Shephard et al., 1995), relative to individuals who may be more sedentary and hold higher status occupations (Canada Health Survey 1982; Fitness Canada, 1983; Stephens et al., 1990). It has also been suggested that individuals who engage in more leisure time physical activity may be at less risk of developing cancer due to other associated lifestyle behaviors such as; adhering to lower fat, higher fiber diets, abstinence from smoking (Shephard et al., 1995; Shephard, 1989), greater adherence to Canada's Food Guide to Healthy Eating and increased consumption of poultry, fish, vegetables and fruit (Highlights of the 1988 Campbell's Survey).

Therefore, determining the risk of obesity per se as it contributes towards the development and or progression of carcinogenesis is very difficult as it may reflect the effects of the amount and or source of calories consumed, the nature of calories in the diet (lipid composition independent of calories), or perhaps the amount of energy expended or any combination thereof. Therefore, the precise mechanism by which "obesity" influences malignancy remains to be fully elucidated (Welsch, 1994), and until then it is recommended that Canadians continue striving for achieving and maintaining a healthy body weight (Canadian Cancer Society, 1987), to reduce their risk of chronic disease, including cancer. A summary of studies on the prevalence of obesity among Canadians appears in Table 7.2.

e) Prevalence of Obesity

Table 7.2 Prevalence of Obesity in Canadian and Alberta Residents

Survey	Population	Description	Prevalence	Method	Year
Canadian Heart Health Surveys, 1992	Canadian Residents 18-74 years	Healthy body weight BMI 20 to 24	40% men 48% women	[a]	1986-1990
Canadian Heart Health Surveys, 1992	Canadian Residents 18-74 years	Obese BMI 27 to 34	32% men 22% women	[a]	1986-1990
Ontario Health Survey, 1990	Ontario Residents 20-64 years	"good weight for most people" BMI 20 to 25	44% men & women	[b]	1990
Ontario Health Survey, 1990	Ontario Residents 20-64 years	"increasing risk of developing health problems" BMI > 27	24% men & women	[b]	1990
Nova Scotia Survey, 1990	Nova Scotia Residents 18-74 years	"increasing risk of developing health problems" BMI > 27	42% men & women	[b]	1990
Alberta Heart Health Survey, 1990	Alberta Residents 18-74 years	"Overweight" BMI > 27	33% men & women	[c]	1990

[a] Anthropometric measurements were performed on fasting, subjects dressed in light indoor clothing without shoes in the morning. Participants stood on a hard surface against the wall and height was measured to the nearest centimeter, using a square and tape measure fixed to the wall. Weight was measured using a calibrated balance beam scale and recorded to the nearest 100 grams. BMI was calculated as weight in kilograms divided by the height in meters squared

[b] Self reported

[c] Calculated from clinic measurements (Anthropometric measurements were performed on subjects dressed in normal indoor clothing without shoes. Participants stood on a hard surface against the wall and height was measured using a square and tape measure fixed to the wall. Weight was measured using a balance beam scale. BMI was calculated as weight in kilograms divided by the height in meters squared)

Data obtained from the National Population Health Survey (1994) suggest that approximately 35% of Canadian men and 26% of Canadian women were obese in 1994 (Trakas and Lawrence, 1999). Evidence suggests that between the mid 1980s and early 1990s the prevalence of obesity among Canadians has increased (Stephens, 1993; Millar and Stephens, 1993). Evidence from the National Population Health Survey (1994-1995) suggest that the odds of being obese significantly increased with increasing age (OR for a 5 year increase in age 1.51, 95% CI 1.43-1.60) and with decreasing rate of physical activity (OR for active vs. moderately active vs. inactive 1.14, 95% CI 1.06-1.23). A decreased likelihood of being obese was associated with higher reported education level (OR for no school vs. elementary school vs. some secondary vs. some post-secondary 0.83, 95% CI 0.78-0.87) and female gender (OR 0.80, 95% CI 0.77-0.83). Obesity in Canada was not (statistically) associated with reported household income level (Trakas et al., 1999). Although individuals classified as obese were significantly ($p < 0.05$) more likely to report heart disease, hypertension, diabetes mellitus, stroke, asthma, arthritis or rheumatism, back problems, emphysema or bronchitis, epilepsy, GI ulcers and urinary incontinence, cancer was not associated with obesity in this analysis (Trakas and Lawrence, 1999). The authors suggest that because cancer was not classified according to subtype it was possible that an association with obesity was diluted by the inclusion of cancers not (etiologically) associated with weight status (Trakas and Lawrence, 1999). Defining "obesity" remains controversial. When comparing results from one survey to another a number of factors need to be considered including age of participants, physical activity, methods employed and defining parameters.

f) Total Energy Intake

It has been recommended that Canadians aim for a daily energy intake of at least 1800 kcal to provide all of the essential nutrients without having to rely upon supplemental sources (Action Towards Healthy Eating, 1990). It is also suggested that energy intake be balanced with adequate levels of physical activity to maintain a healthy body weight. Despite continued efforts to communicate the adverse health risks associated with obesity, the prevalence of obesity remains high among the Canadian population, and is paralleled with a sedentary lifestyle. The average energy requirements for maintaining health, growth, and an appropriate level of physical activity appears in Table 7.3.

Table 7.3 Average Energy Requirements

Age & Sex	Kilo-calories per day
Males 19-24	3000
Males 25-49	2700
Males 50-74	2300
Males 75 +	2000
Females 19-24	2100
Females 25-49	1900
Females 50-74	1800
Females 75 +	1500

FAO/WHO/UNU. 1985. Energy and protein requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. W.H.O. Tech. Rep. Ser. 724.

Nutrition Canada Recommendations, 1990

II. RESULTS

A. Estimated Total Energy Intake

1. Effect of Age and Sex on Total Energy Intake

The average estimated energy intake decreased significantly ($p < 0.05$) with increasing age among males between 18-74 years. The median energy intake exceeded 2000 kilo-calories among males of all ages and 1500 kilo-calories among females of all ages (Table 7.4). The median energy intake among females between 18-74 years was below 1800 kilo-calories (Table 7.4). Moreover, the minimum energy intakes fell below 620 kilo-calories among males and females in each age category (Table 7.4).

Table 7.4 Total Energy Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (kcal)	Standard Deviation	Median (kcal)	Minimum (kcal)	Maximum (kcal)
Males 18-34	275	3176 ^{a}	1843	2911	612	15898
Males 35-49	262	2573 ^{b}	1283	2551	524	8000
Males 50-64	258	2255 ^{c}	741	2183	488	6191
Males 65-74	180	2026 ^{d}	493	2044	285	4016
Females 18-34	312	1924 ^{e}	905	1731	293	5426
Females 35-49	290	1813 ^{e}	707	1681	539	4669
Females 50-64	286	1602 ^{f}	447	1553	533	3880
Females 65-74	176	1514 ^{f}	370	1511	530	4517

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

B. Estimated Body Mass Index

1. Effect of Age and Sex on Body Mass Index

The mean BMI among males and females increased with increasing age. The distribution of weight for height among the Alberta population changed with age. Disproportionately more males and females between 18-34 years reported body mass indices between 20-24.9, while disproportionately more males and females between 50-64 years reported body mass indices of 30 or greater (Table 7.5).

Table 7.5 Percent Distribution of Body Mass Index by Age & Sex (weighed sample)

BMI Category	Males 18-34	Males 35-49	Males 50-64	Females 18-34	Females 35-49	Females 50-64
Mean BMI	26.6	27.7	28.7	24.7	26.4	28.5
< 20	4%	2%	2%	12%	4%	3%
20-24.9	42%	29%	16%	55%	44%	30%
25-27	18%	23%	22%	8%	13%	15%
27.1-29.9	20%	22%	25%	12%	22%	23%
30 or greater	16%	24%	35%	13%	17%	29%
Total	100	100	100	100	100	100
Number in sample	237	259	258	255	277	269

BMI = weight (kg)/height^2 (m)
Proportions are based on un-weighed data.

The mean estimated body mass index among males and females between 20-64 years was approximately 27.2 (data not shown). Females between 18-34 years reported a significantly ($p < 0.05$) lower mean body mass index compared to other age sex groups (Table 7.6).

Table 7.6 Body Mass Index by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (kg/m^2)	Standard Deviation	Minimum (kg/m^2)	Maximum (kg/m^2)
Males 18-34	237	26.6^a	5.8	18.0	49.7
Males 35-49	259	27.7^b	5.2	16.7	56.4
Males 50-64	258	28.7^b	4.1	17.8	59.5
Females 18-34	255	24.7^c	5.1	16.3	48.0
Females 35-49	277	26.4^a	6.2	17.4	67.3
Females 50-64	269	28.5^b	6.3	16.1	69.0

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

2. Effect of Marital Status on Body Mass Index

The mean estimated body mass index among males was approximately 27.8 (data not shown). The body mass index among single males was significantly ($p = 0.0001$) lower than the mean body mass index calculated for married, separated, divorced and widowed males (Table 7.7). The mean estimated body mass index calculated for females was approximately 26.7 (data not shown). There was no significant ($p > 0.05$) effect of marital status on the mean body mass index among females in the Alberta population (Appendix A Table 139).

Table 7.7 Body Mass Index by Marital Status—Males (weighed sample)

Marital Status Males	Sample Size (N)	Mean (kg/m^2)	Standard Deviation	Minimum (kg/m^2)	Maximum (kg/m^2)
Single	130	26.1 ^{a}	5.1	18.0	46.6
Married	546	27.8 ^{b}	5.1	16.7	59.5
Separated, divorced & widowed	78	28.3 ^{b}	4.5	22.4	56.4

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Effect of Income on Body Mass Index

Males who reported household income levels between $30,000-39,999 had a significantly ($p < 0.05$) lower mean body mass index than males who reported income levels of less than $10,000-19,999. The mean body mass index among males was between 27.1-29.9, regardless of reported income level (Table 7.8). There was no significant ($p > 0.05$) effect of reported income level on the mean estimated body mass index among females in the Alberta population (Appendix A Table 140).

Table 7.8 Body Mass Index by Income—Males (weighed sample)

Income Males	Sample Size (N)	Mean (kg/m^2)	Standard Deviation	Minimum (kg/m^2)	Maximum (kg/m^2)
<$10,000-$19,999	94	28.1 ^{a}	6.7	18.0	59.5
$20,000-$29,999	65	27.1 ^{a,b}	5.6	19.2	46.3
$30,000-$39,999	108	27.2 ^{b}	3.7	18.5	39.5
$40,000-$49,999	81	27.2 ^{a,b}	6.5	19.7	49.7
$50,000-$59,999	85	27.2 ^{a,b}	4.5	19.9	43.0
$60,000 +	269	27.9 ^{a,b}	4.5	16.7	48.4
Do not know & refused	52	26.2 ^{b}	5.3	19.9	39.1

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

4. Effect of Employment on Body Mass Index

Females who reported full-time employment had a significantly ($p = 0.0141$) lower mean body mass index than females who reported part-time employment (self-employment or retirement) status and unemployment (homemaker or student) (Table 7.9). The mean body mass index among females was between 25-27, regardless of employment status (Table 7.9). There was no significant ($p > 0.05$) effect of employment status on the mean estimated body mass index among males in the Alberta population (Appendix A Table 143).

Table 7.9 Body Mass Index by Employment—Females (weighed sample)

Employment Females	Sample Size (N)	Mean (kg/m^2)	Standard Deviation	Minimum (kg/m^2)	Maximum (kg/m^2)
Full-time	327	25.7^a	5.1	16.3	54.0
Part-time, Self-employed & Retired	260	26.6^b	6.2	17.1	69.0
Unemployed, Homemaker & Student	214	26.6^b	7.3	16.1	67.9

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

5. Other Factors and their Relationship to Body Mass Index

Their was no significant ($p > 0.05$) effect of educational attainment or smoking on the mean estimated body mass index among males and females in the Alberta population (Appendix A Tables 141 & 142, 144 & 145).

C. Frequency of Eating at Fast Food Restaurants

Note: In the Alberta Nutrition Survey, respondents were asked to identify, during the 24 hour recall, whether any meals were consumed at a restaurant and or cafeteria. Meals consumed away from home (that were not home prepared) were further coded to identify meals eaten at a cafeteria, fast food restaurant, restaurant (with table service), take-out (or deli) or vending machine (or snack bar).

1. Effect of Age and Sex on Eating at Fast Food Restaurants

There was a significant ($p < 0.001$) effect of age and sex on the proportion of Alberta residents that reported eating at fast food restaurants (Table 7.10). Approximately 50% of males and 52% females between 18-34 years reported eating at fast food restaurants 1 to 2 times per week compared to 34% of males and 37% of females between 35-49 years (Table 7.10). Approximately 12% of males and 8% of females between 18-34 years reported eating at fast food restaurants more than 4 times per week (Table 7.10).

Table 7.10 Eating at Fast Food Restaurants by Age & Sex

Age & Sex	Sample Size (N)	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week
Males 18-34	171	21%	50%	16%	12%
Males 35-49	139	50%	34%	11%	5%
Males 50-64	155	76%	18%	3%	3%
Males 65-74	121	85%	12%	1%	2%
Females 18-34	177	31%	52%	9%	8%
Females 35-49	149	59%	37%	3%	1%
Females 50-64	177	83%	15%	1%	1%
Females 65-74	121	90%	8%	2%	0%

Proportions are based on un-weighed data.

2. Effect of Marital Status on Eating at Fast Food Restaurants

There was a significant ($p < 0.001$) effect of marital status on the proportion of Alberta residents that reported eating at fast food restaurants (Table 7.11). Approximately 34% of males and 41% of females who reported being single reported eating out at fast food restaurants 1 to 2 times per week (Table 7.11). Approximately 17% of single males and 11% of single females reported eating at fast restaurants 3 to 4 times per week (Table 7.11). Approximately 29% of males and 23% of females whom reported being separated, divorced or widowed reported eating out at fast restaurants 1 to 2 times per week (Table 7.11).

Table 7.11 Eating at Fast Food Restaurants by Marital Status

	Males (%)				Females (%)			
Marital Status	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week
Single	36%	34%	17%	12%	38%	41%	11%	9%
Married	60%	29%	7%	4%	68%	28%	2%	2%
Separated, divorced & widowed	64%	29%	3%	4%	71%	23%	3%	2%
Chi-square	p < 0.001				p < 0.001			

Proportions are based on un-weighed data.

3. Effect of Income on Eating at Fast Food Restaurants

There was a significant ($p < 0.03$) effect of reported income level on the proportion of males who reported eating at fast food restaurants (Table 7.12). However, there was no significant ($p > 0.05$) effect of reported income level on the proportion of females who reported eating at fast food restaurants (Table 7.12). Approximately 17% of males and

23% of females who reported income levels of less than $10,000-19,999 reported eating at fast food restaurants 1 to 2 times per week. Approximately 33% of males and 39% of females who reported income levels between $50,000-59,999 reported eating at fast food restaurants 1 to 2 times per week (Table 7.12). A greater proportion of males reported eating at fast food restaurants than females. Among residents that reported income levels of $60,000 or greater approximately 13% of males and 4% of females reported eating at fast food restaurants 3 to 4 times per week (Table 7.12 appears at end of chapter 7).

4. Effect of Education on Eating at Fast Food Restaurants

There was a significant ($p < 0.001$) effect of education on the proportion of males and females that reported eating at fast food restaurants (Table 7.13). Approximately 37% of males and 31% of females that completed secondary education reported eating at fast food restaurants 1 to 2 times per week (Table 7.13). Approximately 42% of males and 37% of females that reported some and completed trade and or community college reported eating at fast food restaurants 1 to 2 times per week (Table 7.13). Approximately 26% of males and 35% of females that reported some and completed university reported eating at fast food restaurants 1 to 2 times per week (Table 7.13 appears at end of chapter 7).

5. Effect of Employment on Eating at Fast Food Restaurants

There was a significant ($p < 0.001$) effect of employment status on the proportion of males and females that reported eating at fast food restaurants (Table 7.14). Approximately 37% of males and 44% of females that reported full-time employment reported eating at fast food restaurants 1 to 2 times per week (Table 7.14 appears at end of chapter 7).

6. Other Factors and their Relationship to Eating at Fast Food Restaurants

There was no significant ($p > 0.05$) effect of smoking on the proportion of males and females who reported eating at fast food restaurants (Appendix A Table).

III. SUMMARY OF TOTAL ENERGY INTAKE, BODY MASS INDEX AND EATING AT FAST FOOD RESTAURANTS

The mean estimated energy intakes decreased significantly ($p < 0.05$) with increasing age. The median energy intakes among males exceeded 2000 kilo-calories and among females exceeded 1500 kilo-calories but was below 1800 kilo-calories. The minimum energy intakes for all age sex groups was below 620 kilo-calories.

The mean BMI increased with age, regardless of sex. The mean BMI was significantly ($p < 0.05$) lower among singles males than males who reported being separated, divorced, widowed or married. Males who reported a household income level between $30,000-39,999 had a significantly ($p < 0.05$) lower BMI on average than males who reported a household income level of $19,999 or less. Females who reported full-time employment had a significantly ($p < 0.05$) lower BMI on average than females who reported part-time employment or unemployment status.

The proportion of males and females that reported eating at fast food restaurants 1-2 times per week decreased with increasing age. Approximately 50% of males and 52% of females between 18-34 years reported eating at fast food restaurants 1-2 times per week compared to 34% of males and 37% of females between 35-49 years. Single males and females were more likely to report eating at fast food restaurants 1-2 times per week. Males and females who reported some and completed trade and or community college and females who reported some and completed university were more likely to report eating at fast food restaurants 1-2 times per week. Males and females that reported full-time employment were more likely to report eating at fast food restaurants 1-2 times per week (37% vs 44%; respectively). Males that reported household income levels between $30,000-39,999 were more likely to report eating at fast food restaurants 1-2 times per week (38%).

IV. DISCUSSION

Results from the ANS suggest that males and females between 65-74 years consumed fewer calories (36% and 21%, respectively), on average, than males and females between 18-34 years. In a retrospective analysis Munro (1980) reported that individuals aged 65 years and older consumed approximately 25% fewer calories (on average) than at age 35 years. It has been suggested that the reported decline in total energy intake among older individuals may reflect changes in dietary composition rather than decreased food intake (Senauer, et al., 1991). Senauer et al (1991) reported that individuals aged 65 years and older consume less dietary fat, milk, prepared foods, alcohol and foods consumed away from home, and more fruit and vegetables, cereals and oils, than younger adults. Males and females between 65-74 years consumed significantly ($p < 0.05$) less total fat, calcium rich foods (Appendix C Table 2), alcohol (Table 6.7) and meals eaten at fast food restaurants and significantly ($p < 0.05$) more fibre dense diets (fibre per 1000 kilo-calories), than males and females between 18-34 years.

The proportion of males and females in the ANS that had a BMI of 27.1 or greater increased with increasing age. The proportion of males between 18-34 years (36%), 35-49 years (46%) and 50-64 years (60%) that had a BMI of 27.1 or greater was higher than the proportion of females between 18-34 years (25%), 35-49 years (39%) and 50-64 years (52%); respectively. The estimated prevalence of overweight in the Alberta population is similar to what was reported in 1990, when approximately 47% of males and 37% of females between 35-64 years were classified as overweight ($BMI \geq 27$) (Alberta Heart Health Survey, 1990). This suggests that the prevalence of obesity among Alberta residents, particularly among men, has remained consistent over the last 5 years. The definition of obesity, however, is controversial and healthy risk is defined by more than just weight and height calculations. Future analysis of the ANS will provide information on activity levels and body fat distribution (waist ratio).

In the ANS, males and females between 18-34 years were more likely to report eating at fast food restaurants 1-2 times per week than males and females between 65-74 years. However, males and females between 18-34 years had a significantly ($p < 0.05$) lower body mass index on average than older males and females. This suggests that although older Alberta residents consumed lower energy intakes on average, they were also less likely to report eating at fast food restaurants. Despite this, the prevalence of obesity among older residents appears to be increasing, suggesting that older residents may be less active and expend less energy on average than younger residents. Similar to the ANS, in the Nova Scotia Nutrition Survey (1990), approximately 50% of men and 34% of women between 35-49 years had a BMI of 27 or greater compared to approximately 55% of men and 51% of women between 50-64 years. In the Ontario Health Survey (1990), it was reported that the average body mass index of residents increased with decreased activity level. In 1992, Canadians between 18-34 years (32%) were less likely than Canadians between 35-64 years (42%) and 65-74 years (39%) of age to report following a sedentary lifestyle (Canadian Provincial Heart Health Surveys, 1992).

The relationship between total energy intake and cancer risk is complex (AICR, 1997). Results from an international correlation study suggest that diets low in energy may reduce the overall incidence of cancer and attendant mortality rates (Armstrong and Doll, 1975). Research suggesting that obesity as a risk factor for cancer is strongest for cancers of the endometrium, breast and colon (AICR, 1997). In 2000, it is estimated that 300 new cases of endometrial cancer, 1,650 new cases of breast cancer and 1,240 new cases of colorectal cancer (in men and women) will occur in Alberta. Moreover, research suggests that high levels of physical activity may reduce the risk of cancer in general (Albanes et al., 1989) and risk of breast and colon cancer specifically (AICR, 1997). The data regarding activity levels in the Alberta population and the distribution of adiposity using waist-circumference is currently being analyzed and is unavailable for this report and when completed will help in interpreting this association.

Marshall et al (1991), suggests that their is potential for inappropriate labeling using convenient indicators of obesity, such as body mass index, and that such measures be used with caution. Research also suggests that the under reporting of food intake among obese and non-obese women may further bias results making interpretation of the data suggesting an association between risk of disease and energy intake, obesity and or physical activity difficult (Poppitt et al., 1998). Despite these inconsistencies and the potential for bias, preliminary analysis suggests that the proportion of overweight individuals in the Alberta population has remained relatively constant over the last 5 years. Analysis of food intake data, without the activity data, suggests that a sedentary lifestyle contributes to the high incidence of obesity in older residents. Single males and females, and females that reported full-time employment, were more likely to report eating at fast food restaurants and were more likely to have a lower body mass index on average, suggesting that these groups may be more physically active. Although further analysis (regression analysis) is pending, preliminary results suggest that eating at fast food restaurants 1-2 times per week contributes to higher intakes of total fat (Table 4.7), and higher estimated intakes of salt on average (Table 5.21). Overall, this suggests that programs designed to increase physical activity among Alberta residents, particularly older residents, may be warranted and that alternatives to eating at fast food restaurants be promoted.

Table 7.12 Eating at Fast Food Restaurants by Income

	Males (%)				Females (%)			
Income	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week
<$10,000-$19,999	70%	17%	6%	7%	71%	23%	3%	4%
$20,000-$29,999	59%	31%	2%	8%	69%	26%	1%	4%
$30,000-$39,999	52%	38%	7%	3%	64%	30%	5%	1%
$40,000-$49,999	53%	36%	3%	7%	60%	33%	4%	3%
$50,000-$59,999	54%	33%	11%	2%	54%	39%	2%	5%
$60,000 +	48%	33%	13%	6%	57%	36%	4%	3%
Do not know & refused	59%	21%	11%	9%	70%	22%	7%	1%
Chi-square	$p < 0.031$				$p < 0.437$			

Proportions are based on un-weighed data.

Table 7.13 Eating at Fast Food Restaurants by Education

	Males (%)				Females (%)			
Education	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week
Some secondary & less	77%	16%	2%	5%	81%	17%	1%	1%
Completed secondary	49%	37%	9%	5%	59%	31%	6%	3%
Some & completed trade/community college	42%	42%	9%	6%	57%	37%	1%	5%
Some & completed university	51%	26%	15%	8%	55%	35%	7%	3%
Other education or training	75%	25%	0%	0%	100%	0%	0%	0%
Chi-square	$p < 0.001$				$p < 0.001$			

Proportions are based on un-weighed data.

Table 7.14 Eating at Fast Food Restaurants by Employment

	Males (%)				Females (%)			
Employment	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week	0 times per week	1 to 2 times per week	3 to 4 times per week	4 + times per week
Full-time	43%	37%	11%	8%	46%	44%	5%	5%
Part-time, Self-employed & Retired	70%	22%	4%	4%	74%	22%	3%	1%
Unemployed, Homemaker & Student	49%	30%	14%	7%	71%	24%	3%	3%
Chi-square	$p < 0.001$				$p < 0.001$			

Proportions are based on un-weighed data.

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CHAPTER EIGHT

I. INTRODUCTION

A. NUTRITION CONCERNS AND NUTRIENT INTAKE

a) Literature Review

It has been estimated that by following the dietary recommendations listed in Chapter I and maintaining an active lifestyle, the incidence of cancer in the population can be reduced by 30-40% (AICR, 1997). Although nutrition and health related behaviors are important factors associated with the primary prevention of cancer, less than 50% of Alberta residents believe that cancer incidence is related to lifestyle choices, including dietary choices (Alberta Cancer Report, 1990). More than half of those polled expressed views contrary to the evidences put forth by the scientific literature regarding the potential risk factors associated with developing cancer.

Common Misconceptions Regarding Cancer:

- "everything causes cancer"
- "there isn't much a person can do to prevent cancer"
- "food additives are a major cause of cancer"
- "all pollution causes cancer"

Source: Alberta Cancer Report, 1990

Health care providers, including physicians, are expected to translate research findings from laboratory and epidemiologic studies into dietary strategies for the public and promote diets that are low in fat and high in fibre, particularly vegetables and fruit (Reddy, 2000). Yet, most studies that associate diet with all cause mortality, focus on the role of single nutrients, foods and or food groups. Relatively few studies have addressed the health effects of dietary patterns as it relates to cancer prevention. After controlling for age, sex, education level, total energy intake, and perceived barriers to eating a more healthful diet, results from the 1992 National Health Interview Survey Cancer Epidemiology Supplement, suggest that belief constructs are predictive of dietary behavior (Harnack et al., 1997). The estimated intakes of fat, fibre and vegetable and fruit consumption were more consistent with dietary guidelines among respondents that expressed knowledge about cancer prevention. The purpose of this chapter is to describe the sub population in the ANS who reported choosing or avoiding foods or types of foods because of their concern about cancer. Specifically, the objective was to report on dietary concerns for and intake of specific dietary components identified to alter the risk of developing cancer.

II. RESULTS

The ANS was used to determine, in part, whether residents reported choosing or avoiding foods or types of foods because of their concern about cancer, and how age and sex influenced their perceptions of cancer risk as it relates to diet.

A. Population Who Expressed A Concern About Diet and Cancer

1. Age and Sex

Females were significantly ($p < 0.001$) more likely than males of the same age to report choosing or avoiding foods or types of foods because of a concern about cancer, particularly females between 35-49 years (Table 8.1).

Table 8.1 Residents Who Expressed A Concern About Diet and Cancer by Age & Sex

Age	Males N	Males %	Females N	Females %
18-34 years	25	9	55	18
35-49 years	50	19	97	33
50-64 years	47	18	78	27
65-74 years	30	17	51	29

Proportions are based on un-weighed data.

2. Marital Status

Married females were more likely than single, separated, divorced and widowed females to express a concern about cancer (Table 8.2). Alberta residents were more likely to report being married than single, separated, divorced or widowed.

Table 8.2 Residents Who Expressed A Concern About Diet and Cancer by Marital Status

Marital Status	Males N	Males %	Females N	Females %
Single	15	8	21	12
Married	93	13	173	26
Separated, divorced & widowed	12	12	22	10

Proportions are based on un-weighed data.

3. Income

The proportion of individuals who reported choosing or avoiding foods or types of foods because of a concern about cancer was higher among males who reported household income levels between $40,000-49,999 and among females who reported household income levels between $50,000-59,999 (Table 8.3).

Table 8.3 Residents Who Expressed A Concern About Diet and Cancer by Income

Income	Males N	Males %	Females N	Females %
< $10,000-19,999	17	12	40	21
$20,000-29,999	15	14	26	20
$30,000-39,999	20	14	41	30
$40,000-49,999	20	21	24	20
$50,000-59,999	16	17	36	35
$60,000 +	50	16	67	29
Do not know & refused	13	15	46	29

Proportions are based on un-weighed data.

4. Education

Females who reported some and completed university were more likely to report choosing or avoiding foods or types of foods because of a concern about cancer than residents who reported lower levels of education (Table 8.4). Alberta residents were more likely to report some and completed university than some secondary education or less.

Table 8.4 Residents Who Expressed A Concern About Diet and Cancer by Education

Education	Males N	Males %	Females N	Females %
Some secondary & less	39	16	34	12
Completed secondary	24	13	47	19
Some & completed trade/community college	49	16	64	23
Some & completed university	35	15	67	26
Other education or training	3	33	4	67

Proportions are based on un-weighed data.

5. Employment

There was no effect of employment on the proportion of males and females that reported choosing or avoiding foods or types of foods because of a concern about cancer (Table 8.5). In Alberta males were more likely to report full-time employment and females were more likely to report part-time employment.

Table 8.5 Residents Who Expressed A Concern About Diet and Cancer by Employment

Employment	Males N	Males %	Females N	Females %
Full-time	72	15	88	25
Part-time, self employed & retired	42	10	122	29
Unemployed, homemaker & student	6	7	70	25

Proportions are based on un-weighed data.

6. Smoking

Female smokers were more likely to report choosing or avoiding foods or types of foods because of a concern about cancer than male smokers (Table 8.6).

Table 8.6 Residents Who Expressed A Concern About Diet and Cancer by Smoking

Smoking	Males N	Males %	Females N	Females %
Non-smokers	100	13	233	29
Smokers	20	9	47	18

Proportions are based on un-weighed data.

B. Energy Intake Among Residents Who Expressed A Concern About Diet and Cancer

1. Age and Sex

The average energy intake decreased significantly ($p < 0.05$) with increasing age among males between 18-74 years (Table 8.7). The median energy intake exceeded 2000 kilo-calories among males between 18-64 years and 1500 kilo-calories among females between 18-64 years (Table 8.7). The median energy intake among males and females between 65-74 years exceeded 1800 kilo-calories and 1400 kilo-calories; respectively (Table 8.7).

Table 8.7 Total Energy Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (kcal)	Standard Deviation	Median (kcal)	Minimum (kcal)	Maximum (kcal)
Males 18-34	25	3523^{a}	2055	3530	612	7509
Males 35-49	50	2784^{b}	1831	2320	524	8000
Males 50-64	47	2299^{b}	736	2167	718	6191
Males 65-74	30	1852^{c}	375	1942	966	3083
Females 18-34	55	$1870^{c,d}$	806	1695	540	3402
Females 35-49	97	$1810^{c,d}$	615	1725	823	3777
Females 50-64	78	1515^{d}	440	1535	533	3880
Females 65-74	51	1473^{d}	324	1466	553	2567

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

C. Dietary Fat Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age and Sex

1. Concern About Fat Intake

Significantly ($p < 0.001$) more residents who expressed a concern about cancer reported avoiding foods or types of foods because of the fat content (Table 8.8). Among residents who expressed a concern about cancer, more females than males reported avoiding foods or types of foods because of the fat content (Table 8.8).

Table 8.8 Are you avoiding foods or types of foods because of the fat content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	369 85.2%	121 79.6%	248 88.3%
No	64 14.8%	31 20.4%	33 11.7%
Chi-square	$p < 0.001$	$p < 0.015$	

Proportions are based on un-weighed data.

2. Total Fat Intake

Males between 18-34 years who expressed a concern about cancer consumed significantly ($p < 0.05$) more fat on average than other age sex groups (Table 8.9). Among males, the average dietary fat intake decreased significantly ($p < 0.05$) with increasing age (Table 8.9). The average fat intake of females who expressed a concern about cancer ranged from 44 grams to 67 grams per day among females between 65-74 years and females between 35-49 years; respectively.

Table 8.9 Total Fat Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
Males 18-34	25	117^{a}	85	10	290
Males 35-49	50	100^{b}	83	12	307
Males 50-64	47	$74^{b,c}$	35	20	284
Males 65-74	30	$62^{c,d}$	21	15	161
Females 18-34	55	$59^{c,d,e}$	42	15	171
Females 35-49	97	$67^{c,d,e}$	37	11	184
Females 50-64	78	$48^{d,e}$	21	8	164
Females 65-74	51	44^{e}	18	6	145

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Concern About Saturated Fat Intake

Significantly ($p < 0.001$) more residents who expressed a concern about cancer reported avoiding foods or types of foods because of the saturated fat content (Table 8.10). Among residents who expressed a concern about cancer, significantly ($p < 0.026$) more females than males reported avoiding foods or types of foods because of the saturated fat content (Table 8.10).

Table 8.10 Are you avoiding foods or types of foods because of the saturated fat content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	297 68.6%	94 61.8%	203 72.2%
No	136 31.4%	58 38.2%	78 27.8%
Chi-square	$p < 0.001$	$p < 0.026$	

Proportions are based on un-weighed data.

4. Concern About Unsaturated Fat Intake

Significantly ($p < 0.001$) more residents who expressed a concern about cancer reported choosing to eat foods or types of foods because of the unsaturated fat content (Table 8.11). Among residents who expressed a concern about cancer, significantly ($p < 0.002$) more females than males reported choosing to eat foods or types of foods because of the unsaturated fat content (Table 811).

Table 8.11 Are you choosing to eat foods or types of foods because of the unsaturated fat content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	279 64.4%	83 54.6%	196 69.8%
No	154 35.6%	69 45.4%	85 30.2%
Chi-square	$p < 0.001$	$p < 0.002$	

Proportions are based on un-weighed data.

5. Linoleic Acid Intake

Among males who expressed a concern about cancer, males between 50-64 years consumed significantly ($p < 0.05$) less linoleic acid per day on average than males between 18-34 years (Table 8.12). Females between 65-74 years consumed significantly ($p < 0.05$) less linoleic acid per day on average than males between 18-64 years (Table 8.12).

Table 8.12 Total Linoleic Acid Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
Males 18-34	25	15.8^{a}	16.4	0.9	44.5
Males 35-49	50	$15.4^{a,b}$	20.0	0.8	78.8
Males 50-64	47	10.4^{b}	6.2	1.6	43.0
Males 65-74	30	$9.1^{b,c}$	3.9	2.5	31.6
Females 18-34	55	$7.7^{b,c}$	7.8	0.5	38.6
Females 35-49	97	$9.8^{b,c}$	7.9	0.6	30.1
Females 50-64	78	$8.1^{b,c}$	6.6	0.8	44.0
Females 65-74	51	5.6^{c}	3.9	1.0	56.9

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

6. Concern About Cholesterol Intake

Significantly ($p < 0.001$) more residents who expressed a concern about cancer reported avoiding foods or types of foods because of the cholesterol content (Table 8.13). Among residents who expressed a concern about cancer, significantly ($p < 0.005$) more females than males reported avoiding foods or types of foods because of the cholesterol content (Table 8.13).

Table 8.13 Are you avoiding foods or types of foods because of the cholesterol content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	296 68.4%	91 59.9%	205 72.9%
No	137 31.6%	61 40.1%	76 27.1%
Chi-square	$p < 0.001$	$p < 0.005$	

Proportions are based on un-weighed data.

D. Dietary Fibre Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age and Sex

1. Concern About Fibre Intake

Significantly ($p < 0.001$) more Alberta residents who expressed a concern about cancer reported choosing to eat foods or types of foods because of the fibre content (Table 8.14). More females than males reported choosing to eat foods or types of foods because of the fibre content (Table 8.14).

Table 8.14 Are you choosing to eat foods or types of foods because of the fibre content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	341 78.8%	108 71.1%	233 82.9%
No	92 21.2%	44 28.9%	48 17.1%
Chi-square	$p < 0.001$	$p < 0.001$	$p < 0.001$

Proportions are based on un-weighed data.

2. Dietary Fibre Intake

The average intake of dietary fibre among residents who expressed a concern about cancer was approximately 16.8 grams per day (data not shown). Males between 18-34 years who expressed a concern about cancer consumed significantly ($p < 0.05$) more dietary fibre per day on average than other age sex groups (Table 8.15). Males between 18-74 years who expressed a concern about cancer consumed significantly ($p < 0.05$) more dietary fibre per day on average than females of the same age, with the exception of females between 65-74 years (Table 8.15). The average dietary fibre intake was higher than 20 grams per day among males between 18-49 years (Table 8.15).

Table 8.15 Total Dietary Fibre Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
Males 18-34	25	27.9^{a}	17.7	2.2	50.8
Males 35-49	50	20.3^{b}	15.4	3.0	72.5
Males 50-64	47	$19.4^{b,c}$	6.8	3.4	46.7
Males 65-74	30	$18.4^{b,c}$	8.3	5.6	49.6
Females 18-34	55	14.5^{d}	7.8	3.7	29.3
Females 35-49	97	14.7^{d}	7.9	2.2	39.0
Females 50-64	78	14.1^{d}	4.7	4.1	25.9
Females 65-74	51	$17.9^{c,d}$	7.3	3.9	40.9

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Concern About Sugar Intake

Significantly ($p < 0.001$) more Alberta residents who expressed a concern about cancer reported avoiding foods or types of foods because of the sugar content (Table 8.16). Significantly ($p < 0.001$) more females than males reported avoiding foods or types of foods because of the sugar content (Table 8.16).

Table 8.16 Are you avoiding foods or types of foods because of the sugar content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	279 64.4%	85 55.9%	194 69.0%
No	154 35.6%	67 44.1%	87 31.0%
Chi-square	$p < 0.001$	$p < 0.144$	$p < 0.001$

Proportions are based on un-weighed data.

E. Dietary Antioxidant Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age and Sex

1. Concern About Nutrient Intake

Significantly ($p < 0.001$) more Alberta residents who expressed a concern about cancer reported choosing to eat foods or types of foods because of the nutrients they contain (Table 8.17). More females than males reported choosing to eat foods or types of foods because of the nutrients they contain (Table 8.17).

Table 8.17 Are you choosing to eat foods or types of foods because of the nutrients they contain?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	342 79.0%	109 71.7%	233 82.9%
No	91 21.0%	43 28.3%	48 17.1%
Chi-square	$p < 0.001$	$p < 0.001$	$p < 0.001$

Proportions are bases on un-weighed data.

2. Vitamin A Intake

Among males who expressed a concern about cancer males between 35-49 years and 65-74 years consumed significantly ($p < 0.05$) higher intakes of vitamin A from dietary sources on average than females between 18-34 years and 65-74 years (Table 8.18).

Table 8.18 Vitamin A Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (RE)	Standard Deviation	Median (RE)	Minimum (RE)	Maximum (RE)
Males 18-34	25	$1207^{a,b}$	926	1012	345	2911
Males 35-49	50	2793^{a}	6883	967	56	28790
Males 50-64	47	$1106^{a,b}$	789	824	152	5076
Males 65-74	30	1583^{a}	1009	1305	174	9693
Females 18-34	55	1051^{b}	1279	633	105	4653
Females 35-49	97	$1140^{a,b}$	1129	825	90	13783
Females 50-64	78	$1297^{a,b}$	1268	706	42	6926
Females 65-74	51	999^{b}	709	741	141	4616

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

3. Carotenoid Intake

Among males who expressed a concern about cancer males between 18-34 years consumed significantly ($p < 0.05$) less carotenoids on average than males between 65-74 years (Table 8.19).

Table 8.19 Carotenoid Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (RE)	Standard Deviation	Median (RE)	Minimum (RE)	Maximum (RE)
Males 18-34	25	546^{a}	768	280	35	1965
Males 35-49	50	$998^{a,b}$	1647	303	16	6816
Males 50-64	47	$647^{a,b}$	719	277	32	4280
Males 65-74	30	1091^{b}	904	852	17	7067
Females 18-34	55	$682^{a,b}$	1249	228	5	4484
Females 35-49	97	$774^{a,b}$	1071	434	2	13597
Females 50-64	78	$486^{a,b}$	550	243	3	4195
Females 65-74	51	$643^{a,b}$	735	257	8	4536

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

4. Vitamin C Intake

The average intake of vitamin C from dietary sources was higher than 100 mg per day among both sex groups who expressed a concern about cancer with the exception of males and females between 65-74 years (Table 8.20).

Table 8.20 Vitamin C Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (mg)	Standard Deviation	Median (mg)	Minimum (mg)	Maximum (mg)
Males 18-34	25	226^{a}	330	122	2	1074
Males 35-49	50	$165^{a,b}$	210	117	7	854
Males 50-64	47	$126^{b,c}$	69	108	8	404
Males 65-74	30	88^{c}	58	85	10	649
Females 18-34	55	$145^{b,c}$	144	82	3	437
Females 35-49	97	$111^{b,c}$	101	101	8	549
Females 50-64	78	$123^{b,c}$	95	82	8	599
Females 65-74	51	98^{c}	57	105	3	321

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

F. Dietary Salt Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age and Sex

1. Concern About Salt Intake

Significantly ($p < 0.001$) more Alberta residents who expressed a concern about cancer reported avoiding foods or types of foods because of the salt content (Table 8.21).

More females than males reported avoiding foods or types of foods because of the salt content (Table 8.21).

Table 8.21 Are you avoiding foods or types of foods because of the salt content?

Response Rate	Total 18-74	Males 18-74	Females 18-74
Yes	284 65.6%	91 59.9%	193 68.7%
No	149 34.4%	61 40.1%	88 31.3%
Chi-square	$p < 0.001$	$p < 0.015$	$p < 0.001$

Proportions are based on un-weighed data.

2. Salt Intake

The average intake of salt among males and females between 18-74 years who expressed a concern about cancer was approximately 3048 mg per day (data not shown). Males between 18-34 years who expressed a concern about cancer consumed significantly ($p < 0.05$) higher intakes of salt on average than males between 35-74 years and females of all ages (Table 8.22).

Table 8.22 Salt Intake by Age & Sex (weighed sample)

Age & Sex	Sample Size (N)	Mean (mg)	Standard Deviation	Minimum (mg)	Maximum (mg)
Males 18-34	25	4745^{a}	3627	1425	10272
Males 35-49	50	4003^{b}	3795	370	15216
Males 50-64	47	3349^{b}	1224	292	9164
Males 65-74	30	$2786^{b,c}$	898	1131	7514
Females 18-34	55	$2960^{b,c}$	1785	654	9390
Females 35-49	97	$3392^{b,c}$	4525	598	2943
Females 50-64	78	2223^{c}	779	453	5793
Females 65-74	51	2143^{c}	528	494	4459

For the column, mean intake, means that do not share a common superscript are significantly different ($p < 0.05$).

G. Weekly Alcohol Intake Among Residents Who Expressed A Concern About Diet and Cancer by Age and Sex

1. Concern About Alcohol Intake

Alberta residents who expressed a concern about cancer consumed significantly ($p < 0.05$) fewer alcoholic beverages, bottles of beer and alcohol from spirits per week on average than residents who did not report being concerned about cancer (Table 8.23). The average amount of wine consumed per week among residents who expressed a concern about cancer was no different among residents who did not express a concern (Table 8.23).

Table 8.23 Weekly Alcohol, Beer, Wine & Spirit Intake

	Alcohol		Beer		Wine		Spirits	
	Yes	No	Yes	No	Yes	No	Yes	No
Sample Size (N)	433	1606	433	1606	433	1606	433	1606
Mean (# drinks/week)	3.0^{a}	4.5^{b}	1.1^{a}	2.0^{b}	0.86^{a}	0.78^{a}	1.1^{a}	1.8^{b}
Standard Deviation	5.4	8.2	2.8	4.9	1.9	2.1	3.7	5.1
Median (# drinks/week)	1.0	1.5	0	0	0	0	0	0
Maximum (# drinks/week)	57.5	92.0	24	72	16	28	56	91

For the row, mean (# drinks/week), means that do not share a common superscript are significantly different ($p < 0.05$).

III. SUMMARY OF ALBERTA RESIDENTS WHO EXPRESSED A CONCERN ABOUT CANCER AND THE AMERICAN CANCER SOCIETY'S RECOMMENDATIONS

More females than males reported choosing or avoiding foods or types of foods because of a concern about cancer. Individuals who were more likely to express a concern about cancer included females between 35-49 years, married females and females that reported some and completed university. Males who reported household income levels between $40,000-49,999 and females who reported income levels between $50,000-59,999 were also more likely to express a concern about cancer. Female smokers were more likely to express a concern about cancer than male smokers.

Among residents who expressed a concern about cancer, significantly more males and females reported avoiding foods or types of foods because of the fat content (79.6% vs 88.3%; respectively), saturated fat content (61.8% vs 72.2%), cholesterol content (59.9% vs 72.9%) and salt content (59.9% vs 68.7%); respectively. Significantly more males and females who expressed a concern about cancer reported choosing to eat foods or types of foods because of the unsaturated fat content (54.6% vs 69.8%) and fibre content (71.1% vs 82.9%) and because of the nutrients they contain (71.7% vs 82.9%); respectively. Significantly more females who expressed a concern about cancer reported avoiding foods or types of foods because of the sugar content (69.0%). Alberta residents who expressed a concern about cancer consumed significantly less alcohol, beer and alcohol from spirits per week than residents who did not express a concern about cancer, but consumed similar amounts of wine.

Older males and females who expressed a concern about cancer consumed significantly less energy and lower intakes of fat on average, particularly unsaturated fat (linoleic acid), than younger residents. Males between 18-74 years consumed significantly ($p < 0.05$) higher intakes of dietary fibre on average than females of the same age, with the exception of females between 65-74 years. Males between 65-74 years consumed significantly ($p < 0.05$) higher intakes of vitamin A than females of the same age. Males between 18-34 years consumed significantly ($p < 0.05$) higher intakes of vitamin C on average than older males (50-74 years) and females of all ages. Males between 18-34 years consumed significantly ($p < 0.05$) lower intakes of carotenoids on average than males between 65-74 years and significantly ($p < 0.05$) more salt on average than other age sex groups.

IV. DISCUSSION

In Alberta, it is estimated that out of 1,502,000 males and 1,488,000 females, approximately 4,900 males and 5,200 females will be diagnosed with cancer this year (Canadian Cancer Statistics, 2000). Although the sample size is too small for direct comparisons to the general Alberta population, regarding dietary intake (Chapter IV through Chapter VII), some general trends emerged. Approximately four hundred thirty three respondents, or 1 in 5 Alberta residents, reported choosing or avoiding foods or types of foods because of their concern about cancer. Approximately 1 in 6 males and 1 in 4 females reported being concerned about cancer. In 1994, that represented approximately 147,700 males and 244,000 females between 18-74 years who possibly choose or avoid foods or types of foods because of their concern about cancer specifically.

Harnack et al (1997) suggests that individuals concerned about chronic illness, particularly cancer, are more likely to follow dietary strategies to reduce their risk. In the ANS, females who reported avoiding foods or types of foods because of the fat content consumed significantly lower intakes of fat on average. However, females who reported choosing foods or types of foods because of the fibre content, due to their concern about cancer, consumed average fibre intakes that fell below recommended levels (20 grams per day). Males consumed significantly higher intakes of fibre on average than females however, this may be related to their higher energy intakes rather than their concern about cancer. Although residents who expressed a concern about cancer were more likely to meet the dietary recommendations proposed by cancer agencies, results from the ANS suggest that other factors may influence residents' abilities to translate dietary recommendations into health practices.

Research suggests that several cancers are related to diet. Health promotion programs must not only serve to educate the public regarding the importance of diet to health but also address barriers to dietary change (Harnack et al., 1997). Research suggests that beliefs about the importance of a behavior as it relates to health are correlated with dietary intake (Monneuse et al., 1997). Results from the ANS further suggest that beliefs about particular dietary behaviors, such as consuming a diet that is low in fat, may be more common among females, and may be related to a greater desire to be thin (Monneuse et al., 1997). In 1997, the Tracking Nutrition Trends Survey reported that 92% of Canadian women and 78% of men reported that they consider nutrition important (TNT, 1997). However, research suggests that two thirds of Canadians do not rate themselves knowledgeable about (specific) nutrition issues (TNT, 1997). In the ANS approximately 21% of residents reported choosing or avoiding foods or types of foods because of their concern about cancer. In 1999, the Alberta Cancer Board reported that 46% of Alberta respondents between 18-45 years believed it extremely likely that eating vegetables and fruit could prevent cancer (NKAB, 1999). However, approximately 75% of respondents reported eating less than the recommended number of servings of vegetables and fruit (NKAB, 1999). Data from the ANS suggest that individuals who are concerned about cancer may be more likely to follow the dietary recommendations proposed by cancer agencies. However, nutrition education programs that focus exclusively on increasing awareness about the relationship between nutrition and the prevention of chronic disease without translating recommendations into dietary practice, may be less effective.

V. LITERATURE CITED

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CHAPTER NINE

A. GENERAL DISCUSSION AND CONCLUSION

The current research was conducted to determine whether Alberta residents are following the nutrition recommendations proposed by cancer agencies to reduce the age specific incidence rate of cancer. The ANS is the most recent and comprehensive database to estimate the dietary intake, alcohol consumption and activity patterns of Alberta residents since 1972. Although the percent energy intake from total fat decreased from approximately 40% in 1972 to 30% in 1994, the estimated intake of dietary fibre has remained the same. This suggests that Alberta residents have not replaced their intake of fat with complex carbohydrates, particularly foods high in dietary fibre. The evidence for a reduced risk of cancer is strongest and most consistent for the consumption of vegetables and fruit. Consuming a daily diet high in vegetables and fruit, and thus dietary fibre, is estimated, from epidemiological studies to have the potential to reduce the incidence of cancer by approximately 20% (AICR, 1997). The relatively low intake of dietary fibre and the low estimated intake of foods high in antioxidants, particularly foods containing vitamin C and carotenes, suggest that the consumption of vegetables and fruit among Alberta residents is low. Only an estimated 19% of males and 10% of females between 18-74 years consumed a diet consistent with current recommendations, a diet low in fat (30% or less of total energy intake) and high in dietary fibre (greater than 20 grams per day).

The majority of Alberta residents that reported consuming alcohol, appear to be consuming alcohol within the recommended range. However, it is currently unknown whether Alberta residents consumed alcohol in addition to their normal diets or if they substituted alcohol for part of their energy intake and thus reduced the intake of other energy providing nutrient dense foods. Results from the ANS suggest that obesity has not increased among males and females since 1990. However, preliminary analysis of food intake data, (excluding data on physical activity), suggests that overweight among Alberta residents may be primarily due to a sedentary lifestyle, particularly among older residents. Eating at fast food restaurants 1-2 times per week was associated with higher intakes of fat and salt on average and lower intakes of foods high in dietary fibre, particularly fruit and vegetables. Overall, results from the ANS suggest that on average Alberta residents are not meeting current dietary recommendations.

B. MAJOR FINDINGS

1. Dietary Fat Intake

The main objective was to estimate the dietary fat intake as a percentage of total energy among the Alberta population, and determine the proportion of Alberta residents who may be exceeding the recommendation by consuming a diet high in fat. The average percent energy intake from fat was approximately 30%, which is consistent with current recommendations. However, approximately half of Alberta males and females are still consuming diets that provide more than 30% energy from fat.

Another objective of the ANS was to describe the composition of dietary fat intake among Alberta residents. Alberta males and females continue to obtain more than 10% of their total energy intake as saturated fat and disproportionately less energy from polyunsaturated fat, resulting in average P/S ratios below 1. Results from the ANS suggest that males and females who eat at fast food restaurants 1-2 times per week may be deriving more of their energy from fat, particularly saturated fat. This group consists primarily of younger residents (18-34 years), unemployed males, and females who reported higher household income levels.

Another objective of the ANS was to determine whether the intake of fat is different between smokers and non-smokers. Results suggest that male and female smokers consumed a significantly ($p < 0.05$) greater proportion of energy from fat, particularly saturated fat and monounsaturated fat, and a significantly ($p < 0.05$) lower P/S ratio on average, than non-smokers.

2. Dietary Fibre Intake

The main objective was to describe the dietary fibre intake among Alberta residents, and determine the proportion of Alberta residents who may be consuming a diet low in dietary fibre. The average dietary fibre intake among Alberta residents was approximately 15.5 grams per day. Alberta males and females between 18-74 years consumed approximately 50% of their estimated energy intake from carbohydrates on average. Approximately 75% of Alberta residents consumed dietary fibre intakes below recommended levels of between 20-30 grams per day. The average fibre intake for males was higher ($p < 0.05$) than that of females regardless of age. However, older males and females (50-74 years) consumed significantly ($p < 0.05$) more fibre dense diets than younger residents (18-49 years).

Another objective of the ANS was to determine if dietary fibre intake is different between smokers and non-smokers. Alberta residents who reported smoking consumed significantly ($p < 0.05$) less dietary fibre on average than non-smokers, regardless of sex. Alberta residents that reported smoking were more likely than non-smokers to consume a diet high in fat and low in fibre.

3. Dietary Antioxidant Intake

The main objective was to describe the dietary intake of antioxidants, particularly vitamin A, vitamin C, and carotenes, in the Alberta population. Data from the 24 hour dietary recall suggest that the estimated median intake of vitamin A among males and females between 18-74 years did not meet the respective RNI. However, analysis of the food frequency record is needed before conclusions can be drawn regarding Vitamin A intake in the Alberta population. The estimated dietary intakes of carotenoids and vitamin C suggest that Alberta residents are not consuming the minimum number of recommended servings of vegetables and fruit.

Another objective of the ANS was to determine if smokers consume lower intakes of antioxidants from dietary sources than non-smokers. Results from the ANS suggest that residents who reported smoking were less likely to consume foods high in antioxidants, particularly foods containing carotenoids and vitamin C. Female smokers consumed significantly ($p < 0.05$) lower intakes of carotenoids on average than non-smokers and male and female smokers consumed significantly ($p < 0.05$) lower intakes of vitamin C than non-smokers. Smokers were less likely to meet their respective RNI for vitamin C from dietary sources than non-smokers.

4. Salt Intake

One of the objectives of the ANS was to estimate the consumption of salt among Alberta residents, and determine the proportion of Alberta residents who may be exceeding the recommended level. A new methodology to help estimate salt added in cooking and at the table was used. Although some groups, such as males aged 18-34 years, consumed higher than the population average for salt, the average salt intake for all age sex groups did not exceed 6000 mg per day. There was no significant ($p < 0.05$) effect of smoking on the average estimated salt intake among males and females in the Alberta population.

5. Alcohol Consumption

The main objective was to estimate the weekly alcohol consumption among residents in Alberta, and determine the proportion of Alberta residents who may be exceeding the recommendation. Alberta residents consumed approximately 4.2 drinks per week on average. Alberta males consumed 6.5 drinks per week and females consumed approximately 2.2 drinks per week on average. In the ANS, approximately 60% of males and 40% of females reported consuming alcohol at least once per month. Several sociodemographic and socioeconomic characteristics were associated with alcohol consumption rates and patterns in the Alberta population. Based on the food frequency questionnaire, approximately 14.2% of males and 5.5% of females in Alberta were classified as heavy drinkers.

Another objective of the ANS was to determine if smokers consume more alcohol than non-smokers. Males and females who reported smoking consumed significantly ($p < 0.05$) more drinks, bottles of beer and alcohol from spirits per week on average than non-smokers. There was no significant ($p > 0.05$) effect of smoking on the average weekly consumption of wine.

6. Total Energy Intake and Obesity

The main objective was to describe the range of body mass indices among the Alberta population and determine the proportion of Alberta residents who are described as underweight or overweight according to criteria reported in the NPHS. The proportion of males and females in Alberta that had a BMI of 27.1 or greater increased with increasing age. More males than females between 18-64 years of age had a BMI of 27.1 or greater. The proportion of respondents that had a BMI of less than 20 was highest among males and females between 18-34 years of age (4% and 12%; respectively).

Another objective of the ANS was to estimate the total energy intake among males and females in the Alberta population. The average energy intake decreased significantly ($p < 0.05$) with increasing age for both males and females. The median energy intakes among males exceeded 2000 kilo-calories and among females exceeded 1500 kilo-calories but was below 1800 kilo-calories. Results from the ANS suggest that individuals who reported eating at fast food restaurants 1-2 times per week consumed more energy on average and disproportionately more energy from fat.

C. OTHER FINDINGS

1. Age and sex

Males and females between 18-49 years were less likely than males and females between 50-74 years to consume 30% or less energy from fat. Females between 65-74 years consumed significantly ($p < 0.05$) less saturated fat as a percentage of total energy than males of the same age, resulting in significantly ($p < 0.05$) lower intakes of total fat on average. Males between 18-74 years consumed higher intakes of dietary fibre on average than females of the same age. Males aged 18-49 years and females aged 18-34 years were more likely to consume low levels of dietary carotenoids than older respondents. Females between 18-34 years and males between 35-49 years were less likely to meet their respective RNI for vitamin C from dietary sources. Males and females between 18-34 years consumed higher amounts of alcohol on average per week than males and females between 65-74 years.

2. Marital status

Single males consumed significantly ($p < 0.05$) higher intakes of vitamin C (from dietary sources), and significantly ($p < 0.05$) more salt and more drinks per week, particularly beer, than other males on average. The average body mass index for single males was significantly ($p < 0.05$) lower than the body mass index calculated for other males. Single females consumed significantly ($p < 0.05$) more drinks per week, particularly alcohol from spirits than other females. Approximately 34% of males and 41% of females who reported being single reported eating out at fast food restaurants 1 to 2 times per week.

3. Educational attainment

Females who reported some secondary education and less (40%) were significantly ($p < 0.05$) more likely to have carotenoid intakes within the lowest tertile of intake compared to approximately 28% of females who reported some and completed university. Males and females who reported higher levels of education were significantly ($p < 0.05$) more likely to report eating at fast food restaurants 1-2 times per week than males and females who reported lower levels of education.

4. Reported household income level

Males that reported household income levels between $40,000-49,999 consumed significantly ($p < 0.05$) higher intakes of dietary fibre and significantly ($p < 0.05$) higher intakes of foods containing vitamin C, than males who reported lower income levels. Males who reported household income levels of $30,000 or greater, consumed significantly ($p < 0.05$) higher intakes of salt on average and were also more likely to report eating at fast food restaurants 1-2 times per week. Females who reported higher household income levels consumed significantly ($p < 0.05$) higher average intakes of saturated fat, as a percentage of total energy, than females who reported lower income levels. Females who reported higher income levels also consumed significantly ($p < 0.05$) higher intakes of foods containing carotenoids than females who reported lower income levels. Males and females who reported lower household income levels consumed significantly ($p < 0.05$) fewer drinks per week than residents who reported higher income levels.

5. Employment status

Unemployed males consumed significantly ($p < 0.05$) higher intakes of fat and sources of linolenic acid, on average than employed males. Males who reported unemployment also consumed significantly ($p < 0.05$) higher intakes of vitamin C on average. Part-time employment among males was associated with significantly ($p < 0.05$) lower average intakes of salt. Males and females who reported full-time employment consumed significantly ($p < 0.05$) more drinks per week and were more likely to report eating at fast food restaurants 1-2 times per week than other males and females.

6. Smoking status

Male and female smokers consumed significantly ($p < 0.05$) higher intakes of fat, and a greater proportion of energy from fat, saturated fat and monounsaturated fat on average than non-smokers. Male and female smokers consumed a significantly ($p < 0.05$) lower P/S ratio on average than non-smokers. Male and female smokers consumed significantly ($p < 0.05$) less dietary fibre and significantly lower intakes of carotenoids and vitamin C on average, than non-smokers. Male and female smokers consumed significantly more drinks, beer and alcohol from spirits per week than non-smokers but similar amounts of wine.

D. FUTURE RESEARCH

The data regarding activity levels among males and females in the Alberta population requires analysis as preliminary findings suggest that obesity among residents, particularly older residents, may be due primarily to a sedentary lifestyle. In addition, the proportion of residents who are trying to lose weight need to be identified and categorized according to BMI status, dietary fat and fibre intake and activity level. This may help determine what Alberta residents have been doing to maintain their weight status since 1990. Analysis of the food frequency questionnaire will help categorize Alberta residents' dietary fat intake into low, medium and high intake levels and identify/describe strategies to reduce fat intake. As well, analysis of the food frequency questionnaire will help to validate the intake fat, fibre and select antioxidants, such as carotenoids and vitamin C, that were estimated using the 24 hour dietary recall.

E. LIMITATIONS OF THE STUDY

The ANS is a cross sectional study that identifies and or describes the reported dietary intake, alcohol consumption, height and weight and activity levels of non-institutionalized Alberta residents between 18-74 years of age, at a particular point in time. Therefore, it is not possible to make inferences about Alberta residents across time, and about residents not included in the survey protocol. Statements regarding obesity are currently speculative, pending analysis on activity levels. Generalizations about Alberta residents regarding dietary intake and or activity levels should be made with caution as only 75% of Alberta residents were selected during sampling. As well, the majority of residents that participated in the ANS were contacted by telephone therefore, residents without phone service may be underrepresented in the present study.

F. RECOMMENDATIONS FOR POLICY AND PROCEDURE

Although it would be prudent to continue to encourage smokers to abstain from using tobacco products, results from the ANS suggest that additional opportunities exist for the tobacco industry to inform smokers of the positive dietary changes they can make to help reduce their risk of tobacco related cancers. This may include encouraging smokers to consume more vegetables and fruit and reduce their intake of fat and consumption of alcohol. Similarly, the fast food industry should be encouraged to develop and promote alternative choices that are more consistent with current dietary recommendations. This would include promoting and developing products that are low in fat, high in fibre and include fruit and vegetables. Results from the ANS suggest that educational programs and or interventions that increase dietary fibre intake, particularly fruit and vegetable consumption, are warranted. As well, programs and or interventions that encourage and facilitate lifelong physical activity, particularly among older residents, would be beneficial. The dietary recommendations outlined in the present study are similar to health recommendations proposed by other agencies and may therefore have implications for the incidence of heart and stroke, osteoporosis, obesity and type II diabetes. Therefore, programs and or interventions that enable Alberta residents to achieve current health recommendations may not only reduce the age specific incidence rate of cancer, but may also reduce the incidence rate of other chronic diseases as well.

APPENDIX A

A. Dietary Fat Intake

1. Effect of Marital Status on Total Fat Intake

There was no significant ($p > 0.05$) effect of marital status on the average fat intake among females in Alberta (Table 1).

Table 1 Total Fat Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	173	58 ^{a}	40	3	216
Married	671	60 ^{a}	31	5	189
Separated, divorced & widowed	218	63 ^{a}	34	6	241

2. Effect of Income on Total Fat Intake

There was no significant ($p > 0.05$) effect of reported income level on the average total fat intake among males and females in the Alberta population (Table 2 & Table 3).

Table 2 Total Fat Intake by Income—Males

Income Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	146	89 ^{a}	58	3	307
$20,000-$29,999	107	97 ^{a}	51	5	270
$30,000-$39,999	138	92 ^{a}	42	18	275
$40,000-$49,999	94	96 ^{a}	53	15	238
$50,000-$59,999	96	84 ^{a}	48	10	284
$60,000 +	304	93 ^{a}	51	4	290
Do not know & refused	87	97 ^{a}	89	16	541

Table 3 Total Fat Intake by Income—Females

Income Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	192	54 ^{a}	27	3	241
$20,000-$29,999	127	70 ^{a}	33	8	165
$30,000-$39,999	135	65 ^{a}	40	5	216
$40,000-$49,999	117	59 ^{a}	29	14	173
$50,000-$59,999	102	61 ^{a}	36	15	192
$60,000 +	231	58 ^{a}	31	5	178
Do not know & refused	158	56 ^{a}	38	8	198

3. Effect of Education on Total Fat Intake

There was no significant ($p > 0.05$) effect of educational attainment on the average total fat intake among males and females in the Alberta population (Table 4 & Table 5).

Table 4 Total Fat Intake by Education—Males

Education Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	250	88^{a}	57	3	541
Completed secondary	185	95^{a}	50	8	302
Some & completed trade/community college	296	99^{a}	57	4	307
Some & completed university	231	87^{a}	54	12	275
Other education or training	9	87^{a}	40	33	147

Table 5 Total Fat Intake by Education—Females

Education Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	273	58^{a}	30	6	192
Completed secondary	251	60^{a}	35	8	216
Some & completed trade/community college	275	61^{a}	31	5	241
Some & completed university	258	60^{a}	38	3	184
Other education or training	6	47^{b}	34	13	74

4. Effect of Employment on Total Fat Intake

As confirmed by the Bonferroni procedure, there was no significant ($p > 0.05$) effect of employment status on the average total fat intake among females in the Alberta population (Table 6).

Table 6 Total Fat Intake by Employment—Females

Employment Females	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
Full-time	357	64^{a}	39	5	241
Part-time, Self-employed & Retired	425	59^{b}	30	9	184
Unemployed, Homemaker & Student	281	55^{b}	30	3	189

B. Percent Energy From Total Fat

1. Effect of Income on Percent Energy From Total Fat

There was no significant ($p > 0.05$) effect of reported income level on the average percent energy intake from total fat among males and females in the Alberta population (Table 7 & Table 8).

Table 7 Percent Energy From Fat by Income—Males

Income Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	146	31.4^{a}	9.1	3.7	56.0
$20,000-$29,999	107	31.2^{a}	8.4	2.3	47.1
$30,000-$39,999	138	30.0^{a}	7.6	7.3	61.3
$40,000-$49,999	94	30.4^{a}	9.2	10.6	53.1
$50,000-$59,999	96	28.3^{a}	8.5	10.6	48.6
$60,000 +	304	30.3^{a}	8.8	3.7	55.9
Do not know & refused	87	28.8^{a}	9.8	4.3	55.8

Table 8 Percent Energy From Fat by Income—Females

Income Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	192	28.7^{a}	7.8	1.7	56.2
$20,000-$29,999	127	30.8^{a}	8.7	8.9	48.2
$30,000-$39,999	135	30.3^{a}	10.3	4.7	57.6
$40,000-$49,999	117	29.3^{a}	9.4	13.6	60.6
$50,000-$59,999	102	28.2^{a}	9.4	12.0	48.6
$60,000 +	231	29.7^{a}	9.7	7.6	56.2
Do not know & refused	158	28.2^{a}	10.6	8.4	60.0

2. Effect of Education on Percent Energy From Total Fat

There was no significant ($p > 0.05$) effect of educational attainment on the average percent energy intake from total fat among males and females in the Alberta population (Table 9 &Table 10).

Table 9 Percent Energy From Fat by Education—Males

Education Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	250	$32.1^{a,b}$	8.1	3.7	56.0
Completed secondary	185	$29.4^{a,b}$	8.4	2.3	55.8
Some & completed trade/community college	296	$30.7^{a,b}$	9.1	3.7	55.9
Some & completed university	231	28.7^{a}	8.9	8.9	61.3
Other education or training	9	31.5^{b}	8.9	20.5	55.7

Table 10 Percent Energy From Fat by Education—Females

Education Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	273	29.3^{a}	7.2	4.3	51.3
Completed secondary	251	30.5^{a}	9.8	7.3	60.6
Some & completed trade/community college	275	29.1^{a}	8.8	4.7	50.8
Some & completed university	258	28.7^{a}	11.4	1.7	60.0
Other education or training	6	21.7^{b}	10.8	9.1	36.0

3. Effect of Employment on Percent Energy From Total Fat

There was no significant ($p > 0.05$) effect of employment status on the average percent energy intake from total fat among males and females in the Alberta population (Table 11 & Table 12).

Table 11 Percent Energy From Fat by Employment—Males

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	472	29.4^{a}	9.2	3.7	61.3
Part-time, Self-employed & Retired	413	30.9^{a}	7.5	2.3	56.0
Unemployed, Homemaker & Student	87	31.8^{a}	10.8	8.9	55.8

Table 12 Percent Energy From Fat by Employment—Females

Employment Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	357	30.2^{a}	10.1	4.7	57.6
Part-time, Self-employed & Retired	425	29.9^{a}	8.7	5.8	60.6
Unemployed, Homemaker & Student	281	27.5^{a}	9.4	1.7	56.2

C. Percent Energy From Saturated Fat

1. Effect of Marital Status on Percent Energy From Saturated Fat

There was no significant ($p > 0.05$) effect of marital status on the average percent energy intake from saturated fat among males and females in the Alberta population (Table 13 & Table 14).

Table 13 Percent Energy From Saturated Fat by Marital Status—Males

Marital Status Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Single	176	11.1 [a]	5.1	1.5	28.2
Married	693	12.0 [a]	4.0	0.8	26.0
Separated, divorced & widowed	103	11.4 [a]	3.9	2.4	22.5

Table 14 Percent Energy From Saturated Fat by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Single	173	10.8 [a]	5.1	1.2	23.2
Married	671	11.5 [a]	4.4	1.3	29.0
Separated, divorced & widowed	218	12.2 [a]	3.8	1.9	34.6

2. Effect of Income on Percent Energy From Saturated Fat

There was no significant ($p > 0.05$) effect of reported income level on the average percent energy intake from saturated fat among males in the Alberta population (Table 15).

Table 15 Percent Energy From Saturated Fat by Income—Males

Income Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	146	12.0 [a]	4.1	0.8	28.2
$20,000-$29,999	107	11.9 [a]	3.8	1.5	21.7
$30,000-$39,999	138	11.7 [a]	4.2	2.6	27.6
$40,000-$49,999	94	12.3 [a]	4.4	1.9	22.4
$50,000-$59,999	96	10.8 [a]	4.0	2.2	25.1
$60,000 +	304	11.8 [a]	4.3	2.1	24.5
Do not know & refused	87	11.3 [a]	4.7	1.5	24.0

3. Effect of Education on Percent Energy From Saturated Fat

There was no significant ($p > 0.05$) effect of educational attainment on the average percent energy intake from saturated fat among males and females in the Alberta population (Table 16 & Table 17).

Table 16 Percent Energy From Saturated Fat by Education—Males

Education Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	250	12.6[a]	4.0	0.8	26.0
Completed secondary	185	11.4[a]	4.2	1.5	28.2
Some & completed trade/community college	296	11.9[a]	4.0	2.1	25.0
Some & completed university	231	11.1[a]	4.7	1.9	27.6
Other education or training	9	13.9[b]	4.6	8.1	23.2

Table 17 Percent Energy From Saturated Fat by Education—Females

Education Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	273	11.4[a]	3.6	1.5	26.3
Completed secondary	251	11.8[a]	4.6	2.0	28.5
Some & completed trade/community college	275	11.5[a]	4.0	1.3	25.2
Some & completed university	258	11.1[a]	5.4	1.2	34.6
Other education or training	6	9.1[b]	5.6	2.5	15.4

4. Effect of Employment on Percent Energy From Saturated Fat

There was no significant ($p > 0.05$) effect of employment status on the average percent energy intake from saturated fat among males and females in the Alberta population (Table 18 & Table 19).

Table 18 Percent Energy From Saturated Fat by Employment—Males

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	472	11.3[a]	4.5	1.5	27.6
Part-time, Self-employed & Retired	413	12.0[a]	3.7	0.8	25.1
Unemployed, Homemaker & Student	87	12.6[a]	4.8	2.6	28.2

Table 19 Percent Energy From Saturated Fat by Employment—Females

Employment Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	357	11.9[a]	4.8	1.3	28.5
Part-time, Self-employed & Retired	425	11.5[a]	3.9	1.8	27.5
Unemployed, Homemaker & Student	281	10.8[a]	4.8	1.2	34.6

D. Percent Energy From Monounsaturated Fat

1. Effect of Marital Status on Percent Energy From Monounsaturated Fat

There was no significant ($p > 0.05$) effect of marital status on the average percent energy intake from monounsaturated fat among females in the Alberta population (Table 20).

Table 20 Percent Energy From Monounsaturated Fat by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Single	173	11.7 ^{a}	5.5	0.5	27.2
Married	671	12.5 ^{a}	4.6	1.6	32.1
Separated, divorced & widowed	218	13.0 ^{a}	3.8	1.3	24.5

2. Effect of Income on Percent Energy From Monounsaturated Fat

There was no significant ($p > 0.05$) effect of reported income level on the mean percent energy intake from monounsaturated fat among males and females in the Alberta population (Table 21 & Table 22).

Table 21 Percent Energy From Monounsaturated Fat by Income—Males

Income Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	146	13.9 a	4.6	1.1	30.6
$20,000-$29,999	107	13.9 a	4.6	0.7	24.2
$30,000-$39,999	138	12.7 a	3.6	2.5	25.7
$40,000-$49,999	94	13.2 a	4.8	3.7	24.7
$50,000-$59,999	96	12.2 a	4.2	4.4	25.2
$60,000 +	304	12.9 a	4.3	0.6	27.4
Do not know & refused	87	12.5 a	4.9	2.1	26.7

Table 22 Percent Energy From Monounsaturated Fat by Income—Females

Income Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	192	12.4 a	3.8	0.5	25.4
$20,000-$29,999	127	13.0 a	4.4	3.2	24.4
$30,000-$39,999	135	12.9 a	5.3	1.6	27.2
$40,000-$49,999	117	12.5 a	4.5	5.4	23.3
$50,000-$59,999	102	12.4 a	5.0	4.1	27.0
$60,000 +	231	12.3 a	4.8	2.6	32.1
Do not know & refused	158	11.7 a	4.6	2.9	24.7

3. Effect of Education on Percent Energy From Monounsaturated Fat

There was no significant ($p > 0.05$) effect of educational attainment on the mean percent energy intake from monounsaturated fat among males and females in the Alberta population (Table 23 & Table 24).

Table 23 Percent Energy From Monounsaturated Fat by Education—Males

Education Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	250	14.3[a]	4.2	1.1	30.6
Completed secondary	185	12.9[a]	4.1	0.7	26.7
Some & completed trade/community college	296	13.2[a]	4.7	0.6	27.4
Some & completed university	231	12.1[a]	4.2	3.6	26.7
Other education or training	9	13.4[a]	4.8	8.1	25.8

Table 24 Percent Energy From Monounsaturated Fat by Education—Females

Education Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	273	12.5[a]	3.5	1.3	24.5
Completed secondary	251	13.2[a]	5.0	2.9	27.3
Some & completed trade/community college	275	12.3[a]	4.4	1.6	24.7
Some & completed university	258	11.9[a]	5.3	0.5	32.1
Other education or training	6	8.4[b]	3.9	3.9	14.8

4. Effect of Employment on Percent Energy From Monounsaturated Fat

There was no significant ($p > 0.05$) effect of employment status on the mean percent energy intake from monounsaturated fat among males and females in the Alberta population (Table 25 & Table 26).

Table 25 Percent Energy From Monounsaturated Fat by Employment—Males

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	472	12.7[a]	4.6	0.6	27.4
Part-time, Self-employed & Retired	413	13.3[a]	3.9	0.7	30.6
Unemployed, Homemaker & Student	87	13.6[a]	5.4	3.6	26.7

Table 26 Percent Energy From Monounsaturated Fat by Employment—Females

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	357	12.7 ^{a}	5.0	1.6	27.2
Part-time, Self-employed & Retired	425	12.6 ^{a}	4.2	2.4	32.1
Unemployed, Homemaker & Student	281	11.7 ^{a}	4.6	0.5	24.6

E. Percent Energy From Polyunsaturated Fat

1. Effect of Marital Status on Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of marital status on the mean percent energy intake from polyunsaturated fat among females in the Alberta population (Table 27).

Table 27 Percent Energy From Polyunsaturated Fat by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Single	173	5.3 ^{a}	3.9	0	22.2
Married	671	5.4 ^{a}	3.0	0.6	32.4
Separated, divorced & widowed	218	5.9 ^{a}	4.6	1.1	39.6

2. Effect of Income on Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of reported income level on the mean percent energy intake from polyunsaturated fat among males and females in the Alberta population (Table 28 & Table 29).

Table 28 Percent Energy From Polyunsaturated Fat by Income—Males

Income Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	146	5.5 ^{a}	2.4	1.3	20.6
$20,000-$29,999	107	5.3 ^{a}	2.6	0.1	18.5
$30,000-$39,999	138	5.6 ^{a}	2.6	1.7	15.8
$40,000-$49,999	94	4.9 ^{a}	2.1	1.3	18.1
$50,000-$59,999	96	5.3 ^{a}	2.3	1.5	13.0
$60,000 +	304	5.6 ^{a}	3.1	1.0	18.3
Do not know & refused	87	5.1 ^{a}	2.6	0.7	12.8

Table 29 Percent Energy From Polyunsaturated Fat by Income—Females

Income Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
<$10,000-$19,999	192	5.9^{a}	3.2	0	22.2
$20,000-$29,999	127	5.8^{a}	3.6	1.3	24.8
$30,000-$39,999	135	5.9^{a}	3.2	1.7	23.2
$40,000-$49,999	117	5.0^{a}	3.0	1.5	29.1
$50,000-$59,999	102	4.7^{a}	2.5	1.1	13.1
$60,000 +	231	5.2^{a}	2.8	1.1	19.4
Do not know & refused	158	5.8^{a}	5.6	0.6	39.6

3. Effect of Education on Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of educational attainment on the mean percent energy intake from polyunsaturated fat among males and females in the Alberta population (Table 30 & Table 31).

Table 30 Percent Energy From Polyunsaturated Fat by Education—Males

Education Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	250	5.2^{a}	2.2	0.7	18.5
Completed secondary	185	5.1^{a}	2.1	0.1	18.1
Some & completed trade/community college	296	5.5^{a}	2.9	1.0	15.8
Some & completed university	231	5.5^{a}	3.2	1.7	20.7
Other education or training	9	4.3^{a}	1.0	3.0	6.6

Table 31 Percent Energy From Polyunsaturated Fat by Education—Females

Education Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Some secondary & less	273	$5.4^{a,b}$	2.6	1.1	32.4
Completed secondary	251	$5.4^{a,b}$	3.3	0.6	29.1
Some & completed trade/community college	275	$5.2^{a,b}$	3.2	1.1	23.2
Some & completed university	258	5.8^{a}	4.9	0	39.6
Other education or training	6	4.2^{b}	1.7	1.4	5.7

4. Effect of Employment on Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of employment status on the mean percent energy intake from polyunsaturated fat among males and females in the Alberta population (Table 32 & Table 33).

Table 32 Percent Energy From Polyunsaturated Fat by Employment—Males

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	472	5.3^{a}	2.8	0.7	18.3
Part-time, Self-employed & Retired	413	5.5^{a}	2.4	0.1	18.5
Unemployed, Homemaker & Student	87	5.5^{a}	3.2	1.1	20.6

Table 33 Percent Energy From Polyunsaturated Fat by Employment—Females

Employment Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Full-time	357	5.5^{a}	3.5	0.6	24.8
Part-time, Self-employed & Retired	425	5.9^{a}	4.0	1.1	39.6
Unemployed, Homemaker & Student	281	5.0^{a}	2.9	0	22.2

5. Effect of Smoking on Percent Energy From Polyunsaturated Fat

There was no significant ($p > 0.05$) effect of smoking on the mean percent energy intake from polyunsaturated fat among males and females in the Alberta population (Table 34 & Table 35).

Table 34 Percent Energy From Polyunsaturated Fat by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Non-smokers	743	5.5^{a}	2.7	1.0	20.6
Smokers	229	5.1^{a}	2.5	0.1	18.1

Table 35 Percent Energy From Polyunsaturated Fat by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [%]	Standard Deviation	Minimum [%]	Maximum [%]
Non-smokers	807	5.6^{a}	3.7	0.6	39.6
Smokers	256	5.1^{a}	3.3	0	32.4

F. Polyunsaturated:Saturated Fat Ratio

1. Effect of Marital Status on P/S Ratio

There was no significant ($p > 0.05$) effect of marital status on the mean P/S ratio among males and females in the Alberta population (Table 36 & Table 37).

Table 36 Polyunsaturated—Saturated Fat Ratio by Marital Status—Males

Marital Status Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	176	0.55 [a]	0.44	0.13	2.23
Married	693	0.52 [a]	0.35	0.05	2.76
Separated, divorced & widowed	103	0.56 [a]	0.35	0.09	1.67

Table 37 Polyunsaturated—Saturated Fat Ratio by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	173	0.59 [a]	0.63	0.04	4.30
Married	671	0.56 [a]	0.42	0.07	5.13
Separated, divorced & widowed	218	0.59 [a]	0.65	0.08	5.80

2. Effect of Income on P/S Ratio

There was no significant ($p > 0.05$) effect of reported income level on the mean P/S ratio among males in the Alberta population (Table 38).

Table 38 Polyunsaturated—Saturated Fat Ratio by Income—Males

Income Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	146	0.51 [a]	0.28	0.10	2.41
$20,000-$29,999	107	0.51 [a]	0.32	0.05	2.20
$30,000-$39,999	138	0.59 [a]	0.41	0.09	2.46
$40,000-$49,999	94	0.46 [a]	0.33	0.09	2.59
$50,000-$59,999	96	0.57 [a]	0.43	0.12	2.76
$60,000 +	304	0.54 [a]	0.39	0.09	1.94
Do not know & refused	87	0.52 [a]	0.33	0.10	2.23

3. Effect of Education on P/S Ratio

There was no significant ($p > 0.05$) effect of educational attainment on the mean P/S ratio among males and females in the Alberta population (Table 39 & Table 40).

Table 39 Polyunsaturated—Saturated Fat Ratio by Education—Males

Education Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	250	0.48^{a}	0.29	0.05	2.46
Completed secondary	185	0.53^{a}	0.30	0.06	2.02
Some & completed trade/community college	296	0.51^{a}	0.33	0.10	1.86
Some & completed university	231	0.59^{a}	0.50	0.11	2.76
Other education or training	9	0.35^{b}	0.17	0.14	0.63

Table 40 Polyunsaturated—Saturated Fat Ratio by Education—Females

Education Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	273	0.56^{a}	0.40	0.07	5.13
Completed secondary	251	0.53^{a}	0.37	0.07	2.13
Some & completed trade/community college	275	0.51^{a}	0.37	0.08	2.97
Some & completed university	258	0.66^{a}	0.78	0.04	5.80
Other education or training	6	0.58^{a}	0.36	0.29	1.08

4. Effect of Employment on P/S Ratio

There was no significant ($p > 0.05$) effect of employment on the mean P/S ratio among males and females in the Alberta population (Table 41 & Table 42).

Table 41 Polyunsaturated—Saturated Fat Ratio by Employment—Males

Employment Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	472	0.54^{a}	0.40	0.09	2.76
Part-time, Self-employed & Retired	413	0.53^{a}	0.34	0.06	2.59
Unemployed, Homemaker & Student	87	0.47^{a}	0.29	0.05	1.98

Table 42 Polyunsaturated—Saturated Fat Ratio by Employment—Females

Employment Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	357	0.54^{a}	0.42	0.07	2.97
Part-time, Self-employed & Retired	425	0.62^{a}	0.59	0.07	5.80
Unemployed, Homemaker & Student	281	0.55^{a}	0.49	0.04	4.30

G. Linoleic Acid Intake

1. Effect of Marital Status on Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of marital status on the mean linoleic acid intake among females in the Alberta population (Table 43).

Table 43 Total Linoleic Acid Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	173	7.2^{a}	8	0	43
Married	671	7.8^{a}	8	0	81
Separated, divorced & widowed	218	7.9^{a}	7	1	59

2. Effect of Income on Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of reported income level on the mean linoleic acid intake among males and females in the Alberta population (Table 44 & Table 45).

Table 44 Total Linoleic Acid Intake by Income—Males

Income Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	146	11.9^{a}	13.2	0.3	78.8
$20,000-$29,999	107	12.1^{a}	7.4	0.2	38.3
$30,000-$39,999	138	12.1^{a}	8.2	1.3	46.7
$40,000-$49,999	94	10.8^{a}	8.7	1.6	58.9
$50,000-$59,999	96	10.9^{a}	8.0	0.9	43.0
$60,000 +	304	12.0^{a}	10.4	0.2	61.9
Do not know & refused	87	10.5^{a}	8.9	0.9	35.9

Table 45 Total Linoleic Acid Intake by Income—Females

Income Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	192	7.6^{a}	5.3	0	38.6
$20,000-$29,999	127	9.7^{a}	8.4	0.5	49.1
$30,000-$39,999	135	9.0^{a}	8.4	1.1	48.8
$40,000-$49,999	117	7.0^{a}	6.6	0.9	59.2
$50,000-$59,999	102	7.2^{a}	6.4	0.8	36.0
$60,000 +	231	7.1^{a}	7.4	0.3	54.5
Do not know & refused	158	7.5^{a}	9.9	0.5	81.0

3. Effect of Education on Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of educational attainment on the mean linoleic acid intake among males and females in the Alberta population (Table 46 and Table 47).

Table 46 Total Linoleic Acid Intake by Education—Males

Education Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	250	9.7^{a}	5.9	0.3	54.1
Completed secondary	185	10.9^{a}	7.6	0.2	58.9
Some & completed trade/community college	296	12.8^{a}	11.8	0.2	78.8
Some & completed university	231	12.0^{a}	11.6	0.8	61.9
Other education or training	9	8.7^{a}	3.6	3.9	15.2

Table 47 Total Linoleic Acid Intake by Education—Females

Education Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	273	7.9^{a}	6.8	0.2	81.0
Completed secondary	251	7.6^{a}	7.8	0	59.2
Some & completed trade/community college	275	7.5^{a}	7.8	0.7	49.1
Some & completed university	258	8.1^{a}	8.2	0	56.9
Other education or training	6	6.3^{a}	3.9	1.0	9.6

4. Effect of Employment on Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of employment status on the mean linoleic acid intake among males and females in the Alberta population (Table 48 & 49).

Table 48 Total Linoleic Acid Intake by Employment—Males

Employment Males	Sample Size (N)	Mean (g)	Standard Deviation	Minimum (g)	Maximum (g)
Full-time	472	11.2^{a}	9.7	0.2	61.9
Part-time, Self-employed & Retired	413	11.0^{a}	7.4	0.2	58.9
Unemployed, Homemaker & Student	87	14.8^{b}	17.1	0.7	78.8

Table 49 Total Linoleic Acid Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	357	8.2[a]	8.8	0.3	49.1
Part-time, Self-employed & Retired	425	8.2[a]	7.6	0.5	81.0
Unemployed, Homemaker & Student	281	6.7[a]	5.7	0	54.5

5. Effect of Smoking on Linoleic Acid Intake

There was no significant ($p > 0.05$) effect of smoking on the mean linoleic acid intake among males and females in the Alberta population (Table 50 & Table 51).

Table 50 Total Linoleic Acid Intake by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Non-smokers	743	11.8[a]	9.5	0.2	61.9
Smokers	229	10.9[a]	10.7	0.2	78.8

Table 51 Total Linoleic Acid Intake by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Non-smokers	807	7.7[a]	7.3	0	59.2
Smokers	256	7.9[a]	8.6	0	81.0

H. Linolenic Acid Intake

1. Effect of Marital Status on Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of marital status on the mean linolenic acid intake among males and females in the Alberta population (Table 52 & Table 53).

Table 52 Total Linolenic Acid Intake by Marital Status—Males

Marital Status Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	176	2.2[a]	2.7	0.1	10.7
Married	693	2.0[a]	1.5	0	10.7
Separated, divorced & widowed	103	2.1[a]	1.5	0.2	5.9

Table 53 Total Linolenic Acid Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	173	1.3^a	1.3	0	7.0
Married	671	1.3^a	1.1	0	9.9
Separated, divorced & widowed	218	2.7^a	8.1	0.1	75.0

2. Effect of Income on Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of reported income level on the mean linolenic acid intake among males and females in the Alberta population (Table 54 & Table 55).

Table 54 Total Linolenic Acid Intake by Income—Males

Income Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	146	1.9^a	1.9	0	10.7
$20,000-$29,999	107	2.2^a	1.8	0.1	10.6
$30,000-$39,999	138	2.2^a	1.7	0.2	8.7
$40,000-$49,999	94	2.0^a	1.7	0.2	7.5
$50,000-$59,999	96	1.7^a	1.0	0.1	4.5
$60,000 +	304	2.1^a	1.7	0	8.7
Do not know & refused	87	2.0^a	2.2	0.2	9.6

Table 55 Total Linolenic Acid Intake by Income—Females

Income Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	192	1.3^a	1.0	0	7.0
$20,000-$29,999	127	1.6^a	1.3	0.2	8.0
$30,000-$39,999	135	1.5^a	1.2	0	5.6
$40,000-$49,999	117	1.2^a	0.8	0.2	6.5
$50,000-$59,999	102	1.5^a	1.6	0.2	9.9
$60,000 +	231	1.3^a	1.0	0.1	8.1
Do not know & refused	158	2.4^a	9.5	0.1	75.0

3. Effect of Education on Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of educational attainment on the mean linolenic acid intake among males and females in the Alberta population (Table 56 & Table 57).

Table 56 Total Linolenic Acid Intake by Education—Males

Education Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	250	1.8^{a}	1.4	0.5	8.7
Completed secondary	185	1.9^{a}	1.5	1.4	7.2
Some & completed trade/community college	296	2.2^{a}	2.0	0.5	10.7
Some & completed university	231	2.1^{a}	1.9	0.1	10.7
Other education or training	9	1.7^{a}	1.3	0.7	4.6

Table 57 Total Linolenic Acid Intake by Education—Females

Education Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	273	1.3^{a}	0.9	0	8.0
Completed secondary	251	1.3^{a}	1.0	0	8.1
Some & completed trade/community college	275	1.4^{a}	1.3	0.1	8.0
Some & completed university	258	2.0^{a}	7.5	0.0	75.0
Other education or training	6	0.9^{a}	0.5	0.1	1.6

4. Effect of Employment on Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of employment status on the mean linolenic acid intake among females in the Alberta population (Table 58).

Table 58 Total Linolenic Acid Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	357	1.4^{a}	1.3	0.1	7.1
Part-time, Self-employed & Retired	425	1.9^{a}	5.8	0.1	75.0
Unemployed, Homemaker & Student	281	1.3^{a}	1.2	0	9.9

5. Effect of Smoking on Linolenic Acid Intake

There was no significant ($p > 0.05$) effect of smoking on the mean linolenic acid intake among males and females in the Alberta population (Table 59 & Table 60).

Table 59 Total Linolenic Acid Intake by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Non-smokers	743	2.1^{a}	1.7	0.5	10.7
Smokers	229	2.0^{a}	1.8	0.1	10.7

Table 60 Total Linolenic Acid Intake by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Non-smokers	807	1.6[a]	4.3	0	75.0
Smokers	256	1.4[a]	1.2	0	8.0

I. Omega 6:Omega 3 Ratio

1. Effect of Marital Status on Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of marital status on the mean omega 6:omega 3 ratio among males and females in the Alberta population (Table 61 & Table 62).

Table 61 Omega 6:Omega 3 Fat Ratio Marital Status—Males

Marital Status Males	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Single	176	8.0[a]	8.6	1.4	53.2
Married	693	7.0[a]	6.4	1.5	129.6
Separated, divorced & widowed	103	8.4[a]	8.1	2.1	54.1

Table 62 Omega 6:Omega 3 Fat Ratio Marital Status—Females

Marital Status Females	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Single	173	8.9[a]	22.3	1.1	186.7
Married	671	8.1[a]	10.9	1.2	181.6
Separated, divorced & widowed	218	8.7[a]	19.4	0.3	278.0

2. Effect of Income on Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of reported income level on the mean omega 6:omega 3 ratio among males and females in the Alberta population (Table 63 & Table 64).

Table 63 Omega 6:Omega 3 Fat Ratio by Income—Males

Income Males	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
<$10,000-$19,999	146	7.7[a]	5.2	2.2	54.1
$20,000-$29,999	107	7.9[a]	8.1	1.5	61.1
$30,000-$39,999	138	8.3[a]	7.3	1.6	42.0
$40,000-$49,999	94	6.5[a]	6.8	1.8	129.6
$50,000-$59,999	96	7.9[a]	8.4	2.0	53.2
$60,000 +	304	7.0[a]	7.0	1.5	47.5
Do not know & refused	87	7.0[a]	6.6	1.4	33.9

Table 64 Omega 6:Omega 3 Fat Ratio by Income—Females

Income Females	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
<$10,000-$19,999	192	11.9[a]	21.2	1.1	186.7
$20,000-$29,999	127	10.0[a]	23.5	1.6	278.0
$30,000-$39,999	135	8.2[a]	11.7	1.2	148.0
$40,000-$49,999	117	7.5[a]	11.6	1.5	131.7
$50,000-$59,999	102	6.4[a]	4.7	1.6	20.9
$60,000 +	231	7.2[a]	7.8	1.6	48.3
Do not know & refused	158	8.0[a]	15.8	0.3	181.6

3. Effect of Education on Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of educational attainment on the mean omega 6:omega 3 ratio among males and females in the Alberta population (Table 65 & Table 66).

Table 65 Omega 6:Omega 3 Fat Ratio by Education—Males

Education Males	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Some secondary & less	250	7.2[a]	6.1	1.5	61.1
Completed secondary	185	7.6[a]	8.0	1.6	129.6
Some & completed trade/community college	296	7.7[a]	7.3	1.4	47.5
Some & completed university	231	7.0[a]	7.0	1.5	41.1
Other education or training	9	7.1[a]	4.1	1.9	13.3

Table 66 Omega 6:Omega 3 Fat Ratio by Education—Females

Education Females	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Some secondary & less	273	9.3^{a}	14.1	1.2	181.6
Completed secondary	251	8.4^{a}	18.5	1.3	278.0
Some & completed trade/community college	275	6.9^{a}	6.7	1.4	50.9
Some & completed university	258	9.0^{a}	19.1	0.3	186.7
Other education or training	6	7.5^{a}	4.1	4.3	16.7

4. Effect of Employment on Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of employment status on the mean omega 6:omega 3 ration among males and females in the Alberta population (Table 67 & Table 68).

Table 67 Omega 6:Omega 3 Fat Ratio by Employment—Males

Employment Males	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Full-time	472	7.3^{a}	7.5	1.4	53.2
Part-time, Self-employed & Retired	413	7.5^{a}	6.2	1.5	129.6
Unemployed, Homemaker & Student	87	7.5^{a}	8.2	2.2	39.6

Table 68 Omega 6:Omega 3 Fat Ratio by Employment—Females

Employment Females	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Full-time	357	8.0^{a}	15.3	1.5	278.0
Part-time, Self-employed & Retired	425	8.7^{a}	12.3	0.3	181.6
Unemployed, Homemaker & Student	281	8.4^{a}	18.9	1.4	186.7

5. Effect of Smoking on Omega 6:Omega 3 Ratio

There was no significant ($p > 0.05$) effect of smoking on the mean omega 6:omega 3 ratio among males and females in the Alberta population (Table 69 & Table 70).

Table 69 Omega 6:Omega 3 Fat Ratio by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Non-smokers	743	7.3 ^{a}	6.6	1.4	61.1
Smokers	229	7.7 ^{a}	8.4	1.5	129.6

Table 70 Omega 6:Omega 3 Fat Ratio by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean	Standard Deviation	Minimum	Maximum
Non-smokers	807	8.4 ^{a}	15.4	0.3	278.0
Smokers	256	8.2 ^{a}	14.7	1.3	181.6

J. Dietary Fibre Intake

1. Effect of Marital Status on Dietary Fibre Intake

There was no significant ($p > 0.05$) effect of marital status on the average dietary fibre intake among males and females in the Alberta population (Table 71 & Table 72).

Table 71 Total Dietary Fibre Intake by Marital Status—Males

Marital Status Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	176	20.3 ^{a}	17.6	0.7	108.2
Married	693	17.4 ^{a}	9.0	0	72.5
Separated, divorced & widowed	103	18.3 ^{a}	10.9	0.7	48.2

Table 72 Total Dietary Fibre Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Single	173	14.0 ^{a}	9.5	0	72.7
Married	671	13.6 ^{a}	7.1	1.4	76.5
Separated, divorced & widowed	218	13.7 ^{a}	6.7	1.9	51.3

2. Effect of Income on Dietary Fibre Intake

There was no significant ($p > 0.05$) effect of reported income level on the average dietary fibre intake among females in the Alberta population (Table 73). Residents who did not know or refused to report their household income level consumed significantly ($p < 0.05$) more mean dietary fibre per 1000 kilo-calories than residents who reported income levels between $20,000-39,999 (Table 74).

Table 73 Total Dietary Fibre Intake by Income—Females

Income Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	192	13.1^{a}	7.3	0	72.7
$20,000-$29,999	127	14.5^{a}	7.5	2.6	39.0
$30,000-$39,999	135	15.2^{a}	8.4	1.4	45.8
$40,000-$49,999	117	12.6^{a}	6.2	2.6	41.6
$50,000-$59,999	102	15.4^{a}	8.5	3.4	48.1
$60,000 +	231	12.8^{a}	6.9	0.8	37.8
Do not know & refused	158	13.3^{a}	7.5	3.7	76.5

Table 74 Dietary Fibre Intake Per 1000 Kcal by Income

Income	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
<$10,000-$19,999	338	$7.3^{a,b}$	3.2	0	27.7
$20,000-$29,999	234	7.2^{a}	3.3	0	21.5
$30,000-$39,999	273	7.7^{a}	4.1	1.0	26.4
$40,000-$49,999	211	$7.6^{a,b}$	4.7	1.3	37.7
$50,000-$59,999	198	$7.9^{a,b}$	3.9	0.6	24.3
$60,000 +	535	$7.5^{a,b}$	3.7	1.2	23.8
Do not know & refused	245	7.7^{b}	4.2	0.9	32.6

3. Effect of Education on Dietary Fibre Intake

There was no significant ($p > 0.05$) effect of educational attainment on the average dietary fibre intake among males and females in the Alberta population (Table 75 & Table 76). There was no significant ($p > 0.05$) effect of educational attainment on the amount of fibre consumed per 1000 kilo-calories (Table 77).

Table 75 Total Dietary Fibre Intake by Education—Males

Education Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	250	15.4^{a}	11.2	0.7	108.2
Completed secondary	185	18.5^{a}	10.8	0	58.9
Some & completed trade/community college	296	17.8^{a}	10.8	2.1	72.5
Some & completed university	231	20.3^{a}	12.2	1.5	59.3
Other education or training	9	22.4^{a}	6.8	8.4	29.8

Table 76 Total Dietary Fibre Intake by Education—Females

Education Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Some secondary & less	273	12.2[a]	5.6	1.4	76.5
Completed secondary	251	12.3[a]	6.3	2.2	42.2
Some & completed trade/community college	275	14.4[a]	8.2	1.5	72.7
Some & completed university	258	15.1[a]	8.9	0	51.3
Other education or training	6	11.9[a]	4.1	7.8	19.2

Table 77 Dietary Fibre Intake Per 1000 Kcal by Education

Education	Sample Size [N]	Mean [g/1000 kcal]	Standard Deviation	Minimum [g/1000 kcal]	Maximum [g/1000 kcal]
Some secondary & less	523	7.0[a]	2.9	0.5	21.5
Completed secondary	436	7.2[a]	3.6	0	27.7
Some & completed trade/community college	571	7.2[a]	3.6	0.6	32.6
Some & completed university	489	8.4[a,b]	4.8	0	37.7
Other education or training	15	9.2[b]	4.8	3.5	20.0

4. Effect of Employment on Dietary Fibre Intake

There was no significant ($p > 0.05$) effect of employment status on the average dietary fibre intake among males and females in the Alberta population (Table 78 & Table 79).

Table 78 Total Dietary Fibre Intake by Employment—Males

Employment Males	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	472	18.6[a]	11.8	0.7	72.5
Part-time, Self-employed & Retired	413	17.1[a]	8.0	0	54.7
Unemployed, Homemaker & Student	87	19.8[a]	19.5	1.5	108.2

Table 79 Total Dietary Fibre Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [g]	Standard Deviation	Minimum [g]	Maximum [g]
Full-time	357	13.7[a]	7.5	0.8	39.3
Part-time, Self-employed & Retired	425	13.5[a]	6.5	1.5	51.3
Unemployed, Homemaker & Student	281	14.0[a]	8.7	0	76.5

K. Antioxidant Intake

1. Effect of Marital Status on Vitamin A Intake

There was no significant ($p > 0.05$) effect of marital status on the average vitamin A intake among males and females in the Alberta population (Table 80 & Table 81).

Table 80 Dietary Vitamin A Intake by Marital Status—Males

Marital Status Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Single	176	1445 ^{a}	1939.4	820	5.9	10668.5
Married	693	1382 ^{a}	2272.7	884	32.8	34115.3
Separated, divorced & widowed	103	1121 ^{a}	1626.6	751	13.5	20920.3

Table 81 Dietary Vitamin A Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Single	173	1229.7 ^{a}	1997.1	594	11.1	11008.6
Married	671	1062.1 ^{a}	1192.4	706	2.8	36336.1
Separated, divorced & widowed	218	1032.3 ^{a}	987.1	684	90.1	13158.0

2. Effect of Income on Vitamin A Intake

There was no significant ($p > 0.05$) effect of reported income level on the average vitamin A intake among males and females in the Alberta population (Table 82 & Table 83).

Table 82 Dietary Vitamin A Intake by Income—Males

Income Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
<$10,000-$19,999	146	1250.2 ^{a}	1344.9	791	7.9	7009.1
$20,000-$29,999	107	1302.9 ^{a}	1120.8	832	13.5	7205.9
$30,000-$39,999	138	1426.0 ^{a}	2322.1	926	81.7	34115.3
$40,000-$49,999	94	1911.6 ^{a}	5022.6	876	152.0	28789.9
$50,000-$59,999	96	1220.6 ^{a}	1133.8	819	32.8	12911.3
$60,000 +	304	1416.8 ^{a}	1585.0	911	55.6	10668.5
Do not know & refused	87	993.6 ^{a}	1049.4	801	5.9	9692.6

Table 83 Dietary Vitamin A Intake by Income—Females

Income Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
<$10,000-$19,999	192	913.9 ^{a}	798.6	714	28.9	13158.0
$20,000-$29,999	127	1109.4 ^{a}	866.6	612	95.3	5320.8
$30,000-$39,999	135	1179.5 ^{a}	1668.2	703	2.8	11008.6
$40,000-$49,999	117	1042.1 ^{a}	1151.9	650	11.1	5182.6
$50,000-$59,999	102	1541.7 ^{a}	2177.6	839	95.6	9990.3
$60,000 +	231	1045.1 ^{a}	1414.4	673	7.5	36336.1
Do not know & refused	158	930.5 ^{a}	939.8	634	90.2	6820.1

3. Effect of Education on Vitamin A Intake

There was no significant ($p > 0.05$) effect of educational attainment on the average vitamin A intake among males and females in the Alberta population (Table 84 & Table 85).

Table 84 Dietary Vitamin A Intake by Education—Males

Education Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Some secondary & less	250	1288.2 ^{a}	1390.1	834	5.9	20920.3
Completed secondary	185	1230.7 ^{a}	1421.7	779	32.8	12911.3
Some & completed trade/community college	296	1512.4 ^{a}	3150.3	885	7.9	34115.3
Some & completed university	231	1355.3 ^{a}	1757.0	870	76.1	18950.8
Other education or training	9	1173.4 ^{a}	788.5	812	270.0	3151.6

Table 85 Dietary Vitamin A Intake by Education—Females

Education Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Some secondary & less	273	994.1 ^{a}	1214.6	646	2.8	36336.1
Completed secondary	251	999.2 ^{a}	1016.6	666	28.9	7551.2
Some & completed trade/community college	275	915.5 ^{a}	846.7	701	41.6	13158.0
Some & completed university	258	1393.6 ^{a}	1929.5	704	11.2	13782.9
Other education or training	6	642.0 ^{a}	510.3	266	7.5	1070.7

4. Effect of Employment on Vitamin A Intake

There was no significant ($p > 0.05$) effect of employment status on the average vitamin A intake among males and females in the Alberta population (Table 86 & Table 87).

Table 86 Dietary Vitamin A Intake by Employment—Males

Employment Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Full-time	472	1375.7 ^{a}	2707.9	847	5.9	34115.3
Part-time, Self-employed & Retired	413	1262.6 ^{a}	1298.3	884	13.5	18950.8
Unemployed, Homemaker & Student	87	1655.2 ^{a}	2008.9	823	7.9	7009.1

Table 87 Dietary Vitamin A Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Full-time	357	1039.0 ^{a}	1209.5	634	11.1	13782.9
Part-time, Self-employed & Retired	425	1005.8 ^{a}	868.7	715	41.6	9934.0
Unemployed, Homemaker & Student	281	1263.9 ^{a}	1892.2	718	2.8	36336.1

5. Effect of Smoking on Vitamin A Intake

There was no significant ($p > 0.05$) effect of smoking on the average vitamin A intake among males and females in the Alberta population (Table 88 & Table 89).

Table 88 Dietary Vitamin A Intake by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Non-smokers	743	1327 ^{a}	1536	865	8	34115
Smokers	229	1522 ^{a}	3474	823	6	28790

Table 89 Dietary Vitamin A Intake by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Non-smokers	807	1170 ^{a}	1355	723	7	13783
Smokers	256	824 ^{a}	1179	561	3	36336

1. Effect of Marital Status on Carotenoid Intake

There was no significant ($p > 0.05$) effect of marital status on the average dietary carotenoid intake among males and females in the Alberta population (Table 90 & Table 91).

Table 90 Dietary Carotene Intake by Marital Status—Males

Marital Status Males	Sample Size (N)	Mean (eq)	Standard Deviation	Median (eq)	Minimum (eq)	Maximum (eq)
Single	176	742.8 ^{a,b}	1559.9	250	0	10463.1
Married	693	725.2 ^{a}	1029.3	285	0.2	11627.6
Separated, divorced & widowed	103	540.5 ^{b}	987.4	187	0.6	5946.2

Table 91 Dietary Carotene Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Single	173	879.3 ^{a}	1999.4	195	1.0	10592.8
Married	671	652.4 ^{a}	940.0	277	0	13597.3
Separated, divorced & widowed	218	664.8 ^{a}	841.0	271	2.4	9676.2

2. Effect of Income on Carotenoid Intake

There was no significant ($p > 0.05$) effect of reported income level on the average dietary carotenoid intake among males in the Alberta population (Table 92).

Table 92 Dietary Carotene Intake by Income—Males

Income Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
<$10,000-$19,999	146	556.8 ^{a}	823.1	201	2.0	6218.9
$20,000-$29,999	107	741.3 ^{a}	1122.6	198	0.6	7067.3
$30,000-$39,999	138	653.9 ^{a}	900.6	236	0	4440.4
$40,000-$49,999	94	605.1 ^{a}	846.2	246	0.2	4307.0
$50,000-$59,999	96	759.3 ^{a}	1036.9	247	3.8	11627.6
$60,000 +	304	855.4 ^{a}	1492.0	317	9.1	10463.1
Do not know & refused	87	523.8 ^{a}	828.5	296	5.9	4816.3

3. Effect of Education on Carotenoid Intake

There was no significant ($p < 0.05$) effect of educational attainment on the average dietary carotenoid intake among males and females in the Alberta population (Table 93 & Table 94).

Table 93 Dietary Carotene Intake by Education—Males

Education Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Some secondary & less	250	624.1^{a}	837.8	226	0.6	7067.3
Completed secondary	185	722.5^{a}	1385.9	224	0	11627.6
Some & completed trade/community college	296	705.2^{a}	1091.7	228	2.0	6218.9
Some & completed university	231	765.9^{a}	1266.8	334	3.8	6816.3
Other education or training	9	657.3^{a}	855.5	117	81.0	2480.7

Table 94 Dietary Carotene Intake by Education—Females

Education Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Some secondary & less	273	$624.9^{a,b}$	791.9	230	1.0	5838.0
Completed secondary	251	$566.9^{a,b}$	862.6	220	0	7382.1
Some & completed trade/community college	275	$554.9^{a,b}$	733.0	245	1.7	6399.5
Some & completed university	258	992.5^{a}	1870.5	330	0	13597.3
Other education or training	6	369.6^{b}	372.0	114	6.9	729.7

4. Effect of Employment on Carotenoid Intake

There was no significant ($p > 0.05$) effect of employment status on the average dietary carotenoid intake among males and females in the Alberta population (Table 95 & Table 96).

Table 95 Dietary Carotene Intake by Employment—Males

Employment Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Full-time	472	713.2^{a}	1234.8	218	0	11627.6
Part-time, Self-employed & Retired	413	697.0^{a}	994.9	319	0.6	7676.8
Unemployed, Homemaker & Student	87	751.7^{a}	1254.1	282	2.0	5472.6

Table 96 Dietary Carotene Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Full-time	357	652.4^{a}	1097.8	231	0	13597.3
Part-time, Self-employed & Retired	425	628.3^{a}	760.6	302	1.7	9676.2
Unemployed, Homemaker & Student	281	848.9^{a}	1645.6	225	1.0	10592.8

5. Effect of Smoking on Carotenoid Intake

There was no significant (p > 0.05) effect of smoking on the average dietary carotenoid intake among males in the Alberta population (Table 97).

Table 97 Dietary Carotene Intake by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [eq]	Standard Deviation	Median [eq]	Minimum [eq]	Maximum [eq]
Non-smokers	743	742[a]	1166	297	0	10463
Smokers	229	623[a]	1047	172	0	11628

1. Effect of Marital Status on Vitamin C Intake

There was no significant (p > 0.05) effect of marital status on the average vitamin C intake among females in the Alberta population (Table 98).

Table 98 Dietary Vitamin C Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [mg]	Standard Deviation	Median [mg]	Minimum [mg]	Maximum [mg]
Single	173	114.4[a]	118.4	78	0.9	829.1
Married	671	99.1[a]	92.4	78	0	726.2
Separated, divorced & widowed	218	106.6[a]	96.8	78	1.9	572.6

2. Effect of Income on Vitamin C Intake

There was no significant (p > 0.05) effect of reported income level on the average vitamin C intake among females in the Alberta population (Table 99).

Table 99 Dietary Vitamin C Intake by Income—Females

Income Females	Sample Size [N]	Mean [mg]	Standard Deviation	Median [mg]	Minimum [mg]	Maximum [mg]
<$10,000-$19,999	192	99.0[a]	87.5	69	0.9	829.1
$20,000-$29,999	127	97.3[a]	82.6	71	1.9	541.7
$30,000-$39,999	135	106.8[a]	94.6	78	0	533.2
$40,000-$49,999	117	87.6[a]	69.8	78	1.5	409.0
$50,000-$59,999	102	127.6[a]	111.4	91	5.0	548.6
$60,000 +	231	99.4[a]	96.4	80	0.7	726.2
Do not know & refused	158	111.4[a]	101.7	79	1.8	572.6

3. Effect of Education on Vitamin C Intake

There was no significant ($p > 0.05$) effect of educational attainment on the average vitamin C intake among males and females in the Alberta population (Table 100 & Table 101).

Table 100 Dietary Vitamin C Intake by Education—Males

Education Males	Sample Size [N]	Mean [mg]	Standard Deviation	Median [mg]	Minimum [mg]	Maximum [mg]
Some secondary & less	250	92.0 ^{a,b}	90.3	58	0.1	740.6
Completed secondary	185	121.1 ^{a,b}	125.8	77	0.8	1073.7
Some & completed trade/community college	296	127.6 ^{a,b}	150.4	90	1.1	854.3
Some & completed university	231	144.4 ^{a}	168.9	100	2.2	762.0
Other education or training	9	86.6 ^{b}	78.3	56	27.8	245.3

Table 101 Dietary Vitamin C Intake by Education—Females

Education Females	Sample Size [N]	Mean [mg]	Standard Deviation	Median [mg]	Minimum [mg]	Maximum [mg]
Some secondary & less	273	80.5 ^{a}	68.2	59	0	598.7
Completed secondary	251	91.7 ^{a}	97.3	64	1.3	829.1
Some & completed trade/community college	275	104.2 ^{a}	83.3	80	0.7	572.6
Some & completed university	258	128.1 ^{a}	114.2	98	1.1	726.2
Other education or training	6	100.5 ^{a}	84.5	57	8.2	231.0

4. Effect of Employment on Vitamin C Intake

There was no significant ($p > 0.05$) effect of employment status on the average vitamin C intake among females in the Alberta population (Table 102).

Table 102 Dietary Vitamin C Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [mg]	Standard Deviation	Median [mg]	Minimum [mg]	Maximum [mg]
Full-time	357	104.9 ^{a}	106.2	79	0.9	726.2
Part-time, Self-employed & Retired	425	98.7 ^{a}	78.1	78	0.7	829.1
Unemployed, Homemaker & Student	281	108.9 ^{a}	96.7	76	0	598.7

L. Salt Intake

1. Effect of Marital Status on Salt Intake

There was no significant ($p > 0.05$) effect of marital status on the average salt intake among females in the Alberta population (Table 103).

Table 103 Salt Intake by Marital Status—Females

Marital Status Females	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Single	173	2720^{a}	1545	128	9390
Married	671	2685^{a}	1761	393	27509
Separated, divorced & widowed	218	3101^{a}	3190	299	29430

2. Effect of Income on Salt Intake

There was no significant ($p > 0.05$) effect of reported income level on the average salt intake among females in the Alberta population (Table 104).

Table 104 Salt Intake by Income—Females

Income Females	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
<$10,000-$19,999	192	2436^{a}	1228	128	9390
$20,000-$29,999	127	3030^{a}	1474	644	9883
$30,000-$39,999	135	2806^{a}	1475	393	7856
$40,000-$49,999	117	2647^{a}	1158	598	7092
$50,000-$59,999	102	3186^{a}	3438	474	27509
$60,000 +	231	2571^{a}	1272	453	7090
Do not know & refused	158	2826^{a}	3650	521	2943

3. Effect of Education on Salt Intake

There was no significant ($p > 0.05$) effect of education on the average salt intake among males and females in the Alberta population (Table 105 & Table 106).

Table 105 Salt Intake by Education—Males

Education Males	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Some secondary & less	250	3653 ^{a}	1981	261	17529
Completed secondary	185	4024 ^{a}	2069	292	11645
Some & completed trade/community college	296	4098 ^{a}	2504	409	15009
Some & completed university	231	3887 ^{a}	2592	370	15216
Other education or training	9	3731 ^{a}	1418	1599	6119

Table 106 Salt Intake by Education—Females

Education Females	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Some secondary & less	273	2579 ^{a}	1216	299	7947
Completed secondary	251	2653 ^{a}	2326	474	27509
Some & completed trade/community college	275	2799 ^{a}	1406	134	8029
Some & completed university	258	2941 ^{a}	3053	128	29430
Other education or training	6	1883 ^{a}	931	813	3309

4. Effect of Employment on Salt Intake

There was no significant ($p > 0.05$) effect of employment on the average salt intake among females in the Alberta population (Table 107).

Table 107 Salt Intake by Employment—Females

Employment Females	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Full-time	357	2773 ^{a}	1531	134	9883
Part-time, Self-employed & Retired	425	2829 ^{a}	2800	299	29430
Unemployed, Homemaker & Student	281	2661 ^{a}	1410	128	9390

5. Effect of Smoking on Salt Intake

There was no significant ($p > 0.05$) effect of smoking on the average salt intake among males and females in the Alberta population (Table 108 & Table 109).

Table 108 Salt Intake by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Non-smokers	743	3906 ^{a}	2332	261	17529
Smokers	229	4014 ^{a}	2268	292	14754

Table 109 Salt Intake by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [mg]	Standard Deviation	Minimum [mg]	Maximum [mg]
Non-smokers	807	2791 ^{a}	2304	134	29430
Smokers	256	2652 ^{a}	1314	128	7947

M. Alcohol Intake

1. Effect of Marital Status on Weekly Alcohol Intake

There was no significant ($p > 0.05$) effect of marital status on the weekly alcohol consumption among females in the Alberta population (Table 110).

Table 110 Weekly Alcohol Intake by Marital Status—Females

Marital Status	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Single	173	3.3 ^{a}	5	0	38.0
Married	671	2.0 ^{b}	3	0	25.5
Separated, divorced & widowed	218	2.7 ^{b}	6	0	67.5

2. Effect of Income on Weekly Alcohol Intake

There was no significant ($p > 0.05$) effect of reported income level on the weekly alcohol consumption among females in the Alberta population (Table 111).

Table 111 Weekly Alcohol Intake by Income—Females

Income	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
<$10,000-$19,999	192	2.1 ^{a}	3	0	19.0
$20,000-$29,999	127	1.7 ^{a}	3	0	38.0
$30,000-$39,999	135	2.6 ^{a}	7	0	67.5
$40,000-$49,999	117	3.2 ^{a}	5	0	25.0
$50,000-$59,999	102	2.3 ^{a}	3	0	15.5
$60,000 +	231	2.7 ^{a}	4	0	23.7
Do not know & refused	158	2.0 ^{a}	4	0	25.5

3. Effect of Education on Weekly Alcohol Intake

There was no significant ($p > 0.05$) effect of educational attainment on the weekly alcohol consumption among males and females in the Alberta population (Table 112 & Table 113).

Table 112 Weekly Alcohol Intake by Education—Males

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	250	5.2^{a}	9	0	91.0
Completed secondary	185	7.4^{a}	9	0	92.0
Some & completed trade/community college	296	7.0^{a}	8	0	48.0
Some & completed university	231	5.7^{a}	10	0	54.5
Other education or training	9	5.7^{a}	5	0	26.5

Table 113 Weekly Alcohol Intake by Education—Females

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	273	1.9^{a}	5	0	67.5
Completed secondary	251	2.4^{a}	3	0	22.0
Some & completed trade/community college	275	2.2^{a}	4	0	25.5
Some & completed university	258	2.8^{a}	5	0	38.0
Other education or training	6	1.3^{a}	2	0	5.0

1. Effect of Income on Weekly Beer Intake

There was no significant ($p > 0.05$) effect of reported income level on the weekly beer consumption among males and females in the Alberta population (Table 114 &Table 115).

Table 114 Weekly Beer Intake by Income—Males

Income Males	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
<$10,000-$19,999	146	2.1^{a}	4	0	28.0
$20,000-$29,999	107	2.3^{a}	3	0	33.0
$30,000-$39,999	138	3.2^{a}	6	0	42.0
$40,000-$49,999	94	4.7^{a}	6	0	35.0
$50,000-$59,999	96	4.5^{a}	8	0	36.0
$60,000 +	304	3.6^{a}	7	0	42.0
Do not know & refused	87	3.6^{a}	10	0	72.0

Table 115 Weekly Beer Intake by Income—Females

Income Females	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
<$10,000-$19,999	192	0.8[a]	1	0	12.0
$20,000-$29,999	127	0.5[a]	2	0	36.0
$30,000-$39,999	135	1.0[a]	5	0	48.0
$40,000-$49,999	117	0.9[a]	2	0	8.0
$50,000-$59,999	102	0.6[a]	2	0	8.0
$60,000 +	231	0.7[a]	2	0	15.0
Do not know & refused	158	0.5[a]	1	0	6.0

2. Effect of Education on Weekly Beer Intake

There was no significant ($p > 0.05$) effect of education on the weekly beer consumption among males and females in the Alberta population (Table 116 & Table 117).

Table 116 Weekly Beer Intake by Education—Males

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	250	2.3[a]	7	0	72.0
Completed secondary	185	4.3[a]	6	0	42.0
Some & completed trade/community college	296	4.0[a]	6	0	30.0
Some & completed university	231	3.1[a]	7	0	36.0
Other education or training	9	1.7[a]	2	0	10.0

Table 117 Weekly Beer Intake by Education—Females

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	273	0.8[a]	4	0	48.0
Completed secondary	251	0.7[a]	1	0	8.0
Some & completed trade/community college	275	0.6[a]	2	0	15.0
Some & completed university	258	0.9[a]	3	0	36.0
Other education or training	6	0.2[a]	0.5	0	1.25

3. Effect of Employment on Weekly Beer Intake

There was no significant ($p > 0.05$) effect of employment on the weekly beer consumption among females in the Alberta population (Table 118).

Table 118 Weekly Beer Intake by Employment Status—Females

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	357	0.7^{a}	2	0	36.0
Part-time, Self-employed & Retired	425	0.5^{b}	1	0	15.0
Unemployed, Homemaker & Student	281	1.0^{a}	4	0	48.0

1. Effect of Marital Status on Weekly Wine Intake

There was no significant ($p > 0.05$) effect of marital status on the weekly wine consumption among males and females in the Alberta population (Table 119 & Table 120).

Table 119 Weekly Wine Intake by Marital Status—Males

Marital Status	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Single	176	0.7^{a}	2	0	12.0
Married	693	1.0^{a}	2	0	28.0
Separated, divorced & widowed	103	0.7^{a}	2	0	14.0

Table 120 Weekly Wine Intake by Marital Status—Females

Marital Status	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drihks/week]	Maximum [# drinks/week]
Single	173	0.5^{a}	1	0	10.0
Married	671	0.8^{a}	2	0	15.0
Separated, divorced & widowed	218	0.9^{a}	2	0	14.0

2. Effect of Education on Weekly Wine Intake

There was no significant ($p > 0.05$) effect of educational attainment on the weekly wine consumption among males and females in the Alberta population (Table 121 & Table 122).

Table 121 Weekly Wine Intake by Education—Males

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	250	0.6 ^{a}	2	0	28.0
Completed secondary	185	0.5 ^{a}	2	0	14.0
Some & completed trade/community college	296	0.7 ^{a}	2	0	14.0
Some & completed university	231	1.4 ^{a,b}	3	0	14.0
Other education or training	9	1.9 ^{b}	3	0	16.0

Table 122 Weekly Wine Intake by Education—Females

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	273	0.3 ^{a}	1	0	14.0
Completed secondary	251	0.8 ^{a}	2	0	15.0
Some & completed trade/community college	275	0.9 ^{a}	2	0	10.0
Some & completed university	258	1.0 ^{a}	2	0	14.0
Other education or training	6	1.0 ^{a}	2	0	3.7

3. Effect of Employment on Weekly Wine Intake

There was no significant ($p > 0.05$) effect of employment on the weekly wine consumption among males and females in the Alberta population (Table 123 & Table 124).

Table 123 Weekly Wine Intake by Employment Status—Males

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	472	1.0 ^{a}	2	0	16.0
Part-time, Self-employed & Retired	413	0.9 ^{a}	2	0	28.0
Unemployed, Homemaker & Student	87	0.4 ^{b}	1	0	6.0

Table 124 Weekly Wine Intake by Employment Status—Females

Employment	Sample Size (N)	Mean (# drinks/week)	Standard Deviation	Minimum (# drinks/week)	Maximum (# drinks/week)
Full-time	357	0.9^{a}	2	0	14.0
Part-time, Self-employed & Retired	425	$0.8^{a,b}$	2	0	14.2
Unemployed, Homemaker & Student	281	0.7^{c}	2	0	15.0

4. Effect of Smoking on Weekly Wine Intake

There was no significant ($p > 0.05$) effect of smoking on the weekly wine consumption among males and females in the Alberta population (Table 125 & Table 126).

Table 125 Weekly Wine Intake by Smoking Status—Males

Smoking	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Non-smokers	743	1.0^{a}	2	0	28.0
Smokers	229	0.5^{a}	2	0	16.0

Table 126 Weekly Wine Intake by Smoking Status—Females

Smoking	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Non-smokers	807	0.8^{a}	2	0	15.0
Smokers	256	0.9^{a}	2	0	14.0

1. Effect of Marital Status on Weekly Spirit Intake

There was no significant ($p > 0.05$) effect of marital status on the weekly spirit consumption among males in the Alberta population (Table 127).

Table 127 Weekly Spirit Intake by Marital Status—Males

Marital Status	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Single	176	1.8^{a}	6	0	80.0
Married	693	1.9^{a}	4	0	91.0
Separated, divorced & widowed	103	3.8^{a}	8	0	56.0

2. Effect of Income on Weekly Spirit Intake

There was no significant ($p > 0.05$) effect of reported income level on the weekly spirit intake among females in Alberta (Table 128).

Table 128 Weekly Spirits Intake by Income—Females

Income	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
<$10,000-$19,999	192	1.0[a]	2	0	18.0
$20,000-$29,999	127	0.6[a]	1	0	14.5
$30,000-$39,999	135	0.8[a]	2	0	18.0
$40,000-$49,999	117	1.4[a]	4	0	21.0
$50,000-$59,999	102	0.8[a]	2	0	14.0
$60,000 +	231	0.6[a]	1	0	14.0
Do not know & refused	158	1.0[a]	2	0	14.0

3. Effect of Education on Weekly Spirit Intake

There was no significant ($p > 0.05$) effect of education on the weekly spirit intake among males and females in the Alberta population (Table 129 & Table 130).

Table 129 Weekly Spirits Intake by Education—Males

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	250	2.3[a]	6	0	91.0
Completed secondary	185	2.5[a]	6	0	80.0
Some & completed trade/community college	296	2.3[a]	5	0	28.0
Some & completed university	231	1.2[a]	4	0	42.0
Other education or training	9	2.1[a]	2	0	5.0

Table 130 Weekly Spirits Intake by Education—Females

Education	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Some secondary & less	273	0.8[a]	2	0	18.0
Completed secondary	251	0.9[a]	2	0	21.0
Some & completed trade/community college	275	0.7[a]	2	0	14.0
Some & completed university	258	1.0[a]	3	0	21.0
Other education or training	6	0.1[a]	1	0	3.0

4. Effect of Employment on Weekly Spirit Intake

There was no significant ($p > 0.05$) effect of employment status on the weekly spirit intake among males and females in the Alberta population (Table 131 & Table 132).

Table 131 Weekly Spirits Intake by Employment Status—Males

Employment	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Full-time	472	2.2[a]	5	0	80.0
Part-time, Self-employed & Retired	413	2.2[a]	5	0	91.0
Unemployed, Homemaker & Student	87	0.8[a]	4	0	24.0

Table 132 Weekly Spirits Intake by Employment Status—Females

Employment	Sample Size [N]	Mean [# drinks/week]	Standard Deviation	Minimum [# drinks/week]	Maximum [# drinks/week]
Full-time	357	0.8[a]	2	0	18.0
Part-time, Self-employed & Retired	425	0.9[a]	2	0	21.0
Unemployed, Homemaker & Student	281	0.9[a]	3	0	21.0

1. Effect of Marital Status on Alcohol Intake

There was no significant ($p > 0.05$) effect of marital status on the average alcohol intake among females in the Alberta population (Table 133).

Table 133 Alcohol Intake by Marital Status—Females

Marital Status	Sample Size [N]	Mean [grams]	Standard Deviation	Minimum [grams]	Maximum [grams]
Single	173	5.4[a]	17.2	0	124.9
Married	671	3.2[a]	9.9	0	107.1
Separated, divorced & widowed	218	4.3[a]	13.4	0	135.3

2. Effect of Income on Alcohol Intake

There was no significant ($p > 0.05$) effect of reported income level on the average alcohol intake among females in the Alberta population (Table 134).

Table 134 Alcohol Intake by Income—Females

Income	Sample Size [N]	Mean [grams]	Standard Deviation	Minimum [grams]	Maximum [grams]
<$10,000-$19,999	192	5.5[a]	15.4	0	124.9
$20,000-$29,999	127	2.3[a]	11.6	0	107.1
$30,000-$39,999	135	2.3[a]	7.7	0	63.3
$40,000-$49,999	117	3.6[a]	9.3	0	39.1
$50,000-$59,999	102	3.1[a]	9.0	0	34.8
$60,000 +	231	4.5[a]	10.5	0	54.4
Do not know & refused	158	4.5[a]	16.1	0	135.3

3. Effect of Education on Alcohol Intake

There was no significant ($p > 0.05$) effect of education on the average alcohol intake among males and females in the Alberta population (Table 135 & Table 136).

Table 135 Alcohol Intake by Education—Males

Education	Sample Size [N]	Mean [grams]	Standard Deviation	Minimum [grams]	Maximum [grams]
Some secondary & less	250	7.5[a]	22.4	0	246.6
Completed secondary	185	16.5[a]	36.5	0	285.2
Some & completed trade/community college	296	10.2[a]	20.8	0	184.2
Some & completed university	231	9.2[a]	22.3	0	158.4
Other education or training	9	3.9[a]	6.3	0	14.3

Table 136 Alcohol Intake by Education—Females

Education	Sample Size [N]	Mean [grams]	Standard Deviation	Minimum [grams]	Maximum [grams]
Some secondary & less	273	1.7[a]	6.4	0	78.4
Completed secondary	251	4.3[a]	16.7	0	135.3
Some & completed trade/community college	275	3.0[a]	8.0	0	47.7
Some & completed university	258	5.3[a]	14.7	0	124.9
Other education or training	6	4.0[a]	10.2	0	21.9

4. Effect of Employment on Alcohol Intake

There was no significant ($p > 0.05$) effect of employment status on the average alcohol intake among males and females in the Alberta population (Table 137 & Table 138).

Table 137 Alcohol Intake by Employment Status—Males

Employment	Sample Size [N]	Mean [grams]	Standard Deviation	Minimum [grams]	Maximum [grams]
Full-time	472	12.9^{a}	30.1	0	246.6
Part-time, Self-employed & Retired	413	8.8^{a}	19.7	0	285.2
Unemployed, Homemaker & Student	87	3.8^{a}	16.7	0	137.6

Table 138 Alcohol Intake by Employment Status—Females

Employment	Sample Size (N)	Mean (grams)	Standard Deviation	Minimum (grams)	Maximum (grams)
Full-time	357	4.7^{a}	15.7	0	135.3
Part-time, Self-employed & Retired	425	3.4^{b}	8.5	0	61.8
Unemployed, Homemaker & Student	281	3.1^{b}	11.5	0	124.9

N. Body Mass Index

1. Effect of Marital Status on Body Mass Index

There was no significant ($p > 0.05$) effect of marital status on the mean body mass index among females in the Alberta population (Table 139).

Table 139 Body Mass Index by Marital Status—Females

Marital Status Females	Sample Size (N)	Mean (kg/m^2)	Standard Deviation	Minimum (kg/m^2)	Maximum (kg/m^2)
Single	119	24.6^{a}	4.8	16.4	41.8
Married	555	26.6^{b}	6.6	16.1	69.0
Separated, divorced & widowed	126	26.3$^{a\,b}$	4.7	16.3	48.0

2. Effect of Income on Body Mass Index

There was no significant ($p > 0.05$) effect of reported income level on the mean body mass index among females in the Alberta population (Table 140).

Table 140 Body Mass Index by Income—Females

Income Females	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
<$10,000-$19,999	116	27.1 ^{a}	5.7	16.3	67.9
$20,000-$29,999	91	27.2 ^{a}	9.2	16.1	66.0
$30,000-$39,999	116	26.1 ^{a}	4.4	17.1	42.3
$40,000-$49,999	97	25.6 ^{a}	5.1	16.3	43.9
$50,000-$59,999	87	26.6 ^{a}	6.0	18.7	54.0
$60,000 +	204	25.8 ^{a}	5.9	18.4	67.3
Do not know & refused	89	25.8 ^{a}	6.3	18.4	69.0

3. Effect of Education on Body Mass Index

There was no significant ($p > 0.05$) effect of educational attainment on the mean body mass index among males and females in the Alberta population (Table 141 & Table 142).

Table 141 Body Mass Index by Education—Males

Education Males	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
Some secondary & less	150	29.1 ^{a,b}	5.5	18.5	59.5
Completed secondary	145	27.4 ^{b}	5.1	18.9	49.7
Some & completed trade/community college	257	27.1 ^{b}	4.9	19.5	56.4
Some & completed university	195	27.0 ^{b}	5.0	16.7	48.4
Other education or training	7	29.4 ^{a}	5.1	23.7	44.6

Table 142 Body Mass Index by Education—Females

Education Females	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
Some secondary & less	160	28.4 ^{a}	6.9	16.3	69.0
Completed secondary	192	26.8 ^{a}	6.6	17.2	66.0
Some & completed trade/community college	233	25.4 ^{a}	4.9	16.1	48.6
Some & completed university	211	25.5 ^{a}	5.9	17.2	67.3
Other education or training	5	24.1 ^{a}	3.6	21.4	31.4

4. Effect of Employment on Body Mass Index

There was no significant ($p > 0.05$) effect of employment status on the mean body mass index among males in the Alberta population (Table 143).

Table 143 Body Mass Index by Employment—Males

Employment Males	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
Full-time	445	27.4 ^{a}	5.1	17.8	56.4
Part-time, Self-employed & Retired	245	28.0 ^{a}	4.9	16.7	48.4
Unemployed, Homemaker & Student	64	26.4 ^{a}	5.9	18.0	59.5

5. Effect of Smoking on Body Mass Index

There was no significant ($p > 0.05$) effect of smoking on the mean body mass index among males and females in the Alberta population (Table 144 & Table 145).

Table 144 Body Mass Index by Smoking Status—Males

Smoking Males	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
Non-smokers	562	27.6 ^{a}	5.0	16.7	56.4
Smokers	192	27.0 ^{a}	5.5	18.5	59.5

Table 145 Body Mass Index by Smoking Status—Females

Smoking Females	Sample Size [N]	Mean [kg/m^2]	Standard Deviation	Minimum [kg/m^2]	Maximum [kg/m^2]
Non-smokers	586	26.2 ^{a}	5.9	16.4	69.0
Smokers	215	26.2 ^{a}	6.6	16.1	67.3